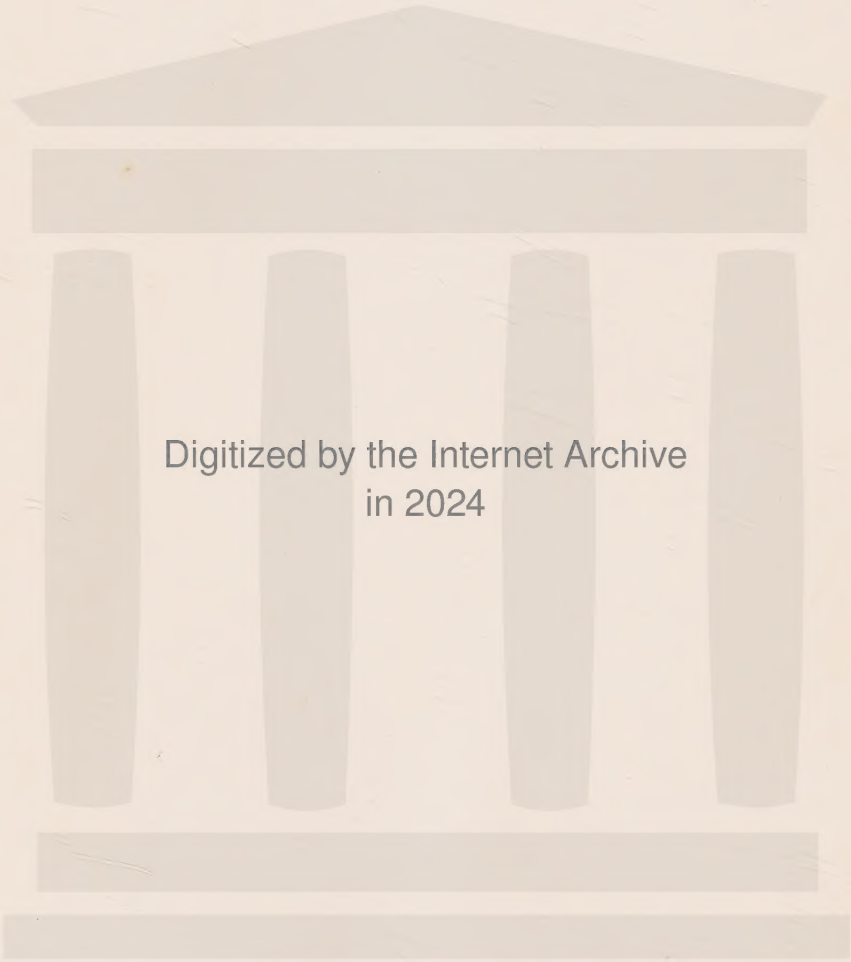
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THE

PRACTICE OF MEDICINE

BY

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WITH SECTIONS ON

DISEASES OF THE NERVOUS SYSTEM

BY

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VOLUME II.

DISEASES OF THE CIRCULATORY, RESPIRATORY, URINARY, AND DIGESTIVE SYSTEMS, DISEASES OF THE BLOOD AND CONSTITUTIONAL AND PARASITIC DISEASES.

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PRACTICE OF MEDICINE.

DISEASES OF THE HEART AND BLOOD-VESSELS.

Before proceeding to a consideration of the various affections of the organs of circulation, it is important to have clearly in mind the essential anatomical and physiological data relating to this system, as they have an important bearing upon accurate clinical work.

I. Anatomy.—The normal heart of the adult male weighs, as a rule, from ten to eleven ounces; that of woman from one to two ounces less. The containing capacity of the various cavities of the heart is about the same for each—*i. e.*, three fluid ounces, under moderate distention. Slight differences exist, of course; the right side of the heart is more capacious than the left, and the ventricles more than the auricles. The thickness of the cardiac walls varies at different points. The walls of the left heart are much thicker than those of the right. The left ventricle at its centre has a thickness of upwards of five lines, and the left auricle about one-third that. The right ventricle has walls but two lines in thickness, while the corresponding auricle is still thinner, its walls being but one line thick.

Orifices of the Heart. The orifices of the heart are the opening of the vena cava into the right auricle, the right auriculo-ventricular orifice, also called the tricuspid orifice, the pulmonary orifice being the point of exit of the blood from the right ventricle through the pulmonary artery, the openings of the pulmonary veins into the left auricle, the left auriculo-ventricular or mitral orifice, and the aortic orifice which is the point of exit of the blood from the left ventricle into the aorta.

Valves. The valves of the heart are stationed at the auriculo-ventricular, pulmonary and aortic orifices. They consist of leaflets of the lining membrane of the heart, so arranged as to prevent the circulation of the blood in any other than a normal direction. The mitral, aortic and pulmonary orifices are each guarded by two of these leaflets; the right auriculo-ventricular, or tricuspid orifice, by three.

The Pericardium, viewed *in situ*, appears rather conical in shape, the apex being situated above at about the level of the second costal cartilage; its base rests upon the diaphragm, to the central tendon and neighboring surface of which it is attached. It is perforated above by the aorta with its branches, by the pulmonary vessels, and by the superior vena cava. It is composed externally of a tough, fibrous tissue, and internally of a serous membrane, which also envelopes the heart and the first portions of the great vessels. The fibrous layer is continued upon and merges into the adventitia of the vessels. In health the pericardial sac contains a small quantity of serous fluid, which acts as a lubricant.

Position of the Heart and its Relation to Neighboring Organs. The heart is unattached, excepting at its base, where it is anchored by the great vessels. Its apex, which is composed entirely of the left ventricle, points downward, outward, and to the left, coming in contact with the chest wall in the fifth intercostal space well within the left nipple line and about three and a quarter inches to the left of the mid-sternum. Resting in the middle mediastinum, the heart occupies most of the space represented superficially by the sternum and costal cartilages, but extending more to the left, two-thirds of the organ lying to the left of the mid-sternal line. The position of the apex is not exactly the same in all healthy persons. It is furthermore modified by the respiratory movements, and by the position of the patient—*i. e.*, whether he is lying or sitting. In the lying position the apex usually rises; if it has been felt in the fifth interspace while upright, during recumbency its stroke may be appreciable behind the fifth rib. The longitudinal furrow upon the anterior surface of the heart represents the line of division between the two ventricles. A transverse groove separates the auricles from the ventricles.

It is highly important for diagnostic purposes to possess an accurate knowledge of the relationship of the heart and its various parts, and of the large bloodvessels, to the surface of the chest. A line drawn from the heart's apex in the left fifth interspace to the second interspace, the line intersecting the middle of the left second costal cartilage, will mark the outer boundary of the left ventricle. The outer margin of the right ventricle, which looks downward, may be fairly well defined by drawing a line from the point of juncture of the fifth right cartilage with the sternum to the heart's apex in the left fifth interspace. The right auricle lies behind the right edge of the sternum and the right third, fourth and fifth costal cartilages and the included interspaces. The left auricle occupies the space included between the lower edge of the left second intercostal cartilage and the upper margin of the fourth at their sternal ends. The groove between the auricles and the ventricles corresponds to a line drawn from the upper edge of the sixth right costal cartilage to the left third cartilage.

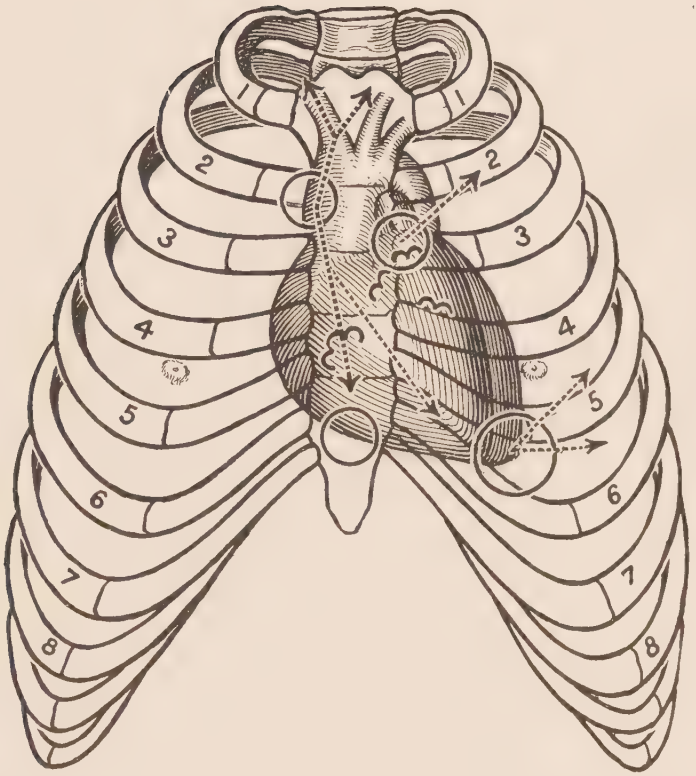


DIAGRAM SHOWING THE RELATIONSHIP OF THE HEART AND GREAT BLOODVESSELS TO THE ANTERIOR WALL OF THE CHEST; ALSO THE LOCATION OF THE SEVERAL VALVES, AND OF THE AREAS WITHIN WHICH THE MURMURS PRODUCED AT THE SEVERAL VALVES ARE HEARD.

The direction of transmission of murmurs is indicated by arrows.

The mitral area is indicated by the circle at the apex of the heart; the tricuspid area by that upon the lower portion of the sternum; while the aortic area is at the base of the heart, upon the right; the pulmonary upon the left.

Location of the Valves. The mitral valve is situated behind the sternum near its left border and upon a level with the fourth cartilage. The tricuspid valve is also behind the sternum on a level with the fourth interspace. The aortic and pulmonary valves are nearly upon the same level, the latter being slightly the higher. The aortic is the deeper placed, lying behind the sternum at its left edge, partially behind the lower portion of the third left cartilage and the third interspace. The pulmonary valve lies partly behind the sternum and partly behind the left third costal cartilage.

Posteriorly the heart is separated from the vertebræ by the œsophagus and the thoracic aorta. The lungs bound it laterally; the great vessels and the roots of the lungs are above, while below, the diaphragm intervenes between it and the liver and the stomach. Anteriorly it is separated from the chest parieties over most of its area by the lungs. The exposed surface of the heart is lessened when the lungs are dilated as by emphysema, and enlarged when the lungs are shrunken and retracted, as from chronic pulmonary disease. In health the lungs are almost in contact as low as the fourth costal cartilages. At this point the left lung retreats from the median line, the border being represented by a line drawn towards the apex of the heart.

The aorta extends upward and to the right beneath the sternum, projecting for one-fourth to one-third inch to the right of that bone in the second and first intercostal spaces. The ascending aorta in its first portion is covered by the pulmonary artery. The transverse section of the arch lies beneath the lower half of the manubrium sterni. The superior vena cava lies behind the ascending aorta, but extends three-fourths of an inch to the right of the sternum. The pulmonary artery emerging from between the auricles, extends upward, backward and to the left, approaching the surface in the left second intercostal space. It then passes beneath the aortic arch and divides into its two branches.

II. Physiology of the Heart and Arteries.—The continuous flow of blood through the arteries, arterioles, capillaries and veins, is maintained mainly by the rhythmical contraction of the heart. For obvious reasons, the experimental study of the heart's action has been confined very largely to the lower order of mammalians. In man but little has been learned excepting from the heart's action as studied upon the chest wall, *i. e.*, from observation of the cardiac impulse.

The Heart's Movements. The heart's contraction (or systole) begins in the auricles at an instant when these cavities are distended with blood which has been received from the large veins. The contraction extends downward to the auriculo-ventricular openings. The succeeding contraction of the ventricles is attended by a closure of the auriculo-ventricular valves and an opening of the semilunar valves at the aortic and pulmonary orifices. The contractions of the walls of the cavities are

probably stimulated by their previous distention. The ventricular systole discharges the contents of the ventricles into the arteries with considerable force, which is the cause of the arterial impulse, and is attended by the apex beat, *i. e.*, the heart's impulse upon the chest wall. The tilting forward of the heart is due partly to the ventricular systole, partly to the filling of the great arteries at the base, the latter creating a point of greater fixity. The ventricles also rotate slightly from left to right. The heart's contractions are repeated in the healthy adult about seventy-two times per minute. The area upon the thorax within which the normal impulse may be felt varies much, being dependent largely upon the thickness of the chest wall. Active exercise and excitement increase its force and area. The action of the right ventricle is not infrequently communicated to the epigastrium. During the systole of the ventricles the auricles, which are contracted at its beginning, dilate and are passively filled by the time of the completion of the ventricular contraction. At the moment the auricles are well filled the closed ventricles are relaxing, the semilunar valves guarding the pulmonary and aortic orifices closing, and the auriculo-ventricular valves opening, thus permitting the blood to flow into the ventricles. At first the flow of blood into the ventricles is passive, but as soon as the auricles begin to contract it becomes active; the more rapid flow distends the ventricles, and then follows the ventricular systole. So rapid and regular is the contraction of the heart muscle from above downward, *i. e.*, from the auricles to the ventricles, that it appears almost as a continuous peristalsis. A graphic study of the heart's impulse may be made by the cardiograph, an instrument devised by Marey and improved by Sanderson, but which thus far has proven of greater physiological interest than of clinical value.

The Heart Sounds.—The heart's action is attended by certain sounds, between which there are observed intervals of silence. These we speak of as the first and second sounds, and the first and second pauses, and are best studied in the order in which they occur in the normal heart action. Each possesses characteristics which give it identity.

The FIRST SOUND is the most remarkable feature of the heart's action, It is characterized by its length (being longer than the second sound). and by its dull or less ringing quality. Flint called it "booming." It is heard over the entire cardiac region, but in its greatest intensity at the apex of the heart. Careful observation enables one to separate this sound into two elements—namely, that dependent upon muscular contraction, and that produced by closure of the valves.

The SECOND SOUND follows closely upon the first or systole of the heart, a barely appreciable interval of silence, called the first or short pause, intervening. The second sound is shorter, feebler and more elevated in pitch than is the first, and possesses a distinctly valvular character. It is heard in its greatest intensity over the base of the heart,

and especially so within a small area covered by the right second intercostal space and cartilage close to the sternum (the aortic area). These statements as to the areas of maximum intensity and diffusion of both sounds apply to the majority of individuals, but it must be remembered that departures from the so-called normal are observed in many apparently healthy persons.

In order to study the causes of the heart's sounds it is necessary that the events which occur at the moments of production of the same, as well as during the intervening periods of silence, should be understood. They are as follows:

First Sound. Contraction of the ventricles, sudden tension upon the auriculo-ventricular valves, flow of blood into the aorta and the pulmonary artery.

Second Sound. Dilatation of the ventricles, opening of the auriculo-ventricular valves, progressive dilatation of the auricles, closure and sudden tension of the semilunar valves, and recoil of the heart and the great arteries.

First Pause. Impulse of the heart, injection of the blood into the arteries.

Second Pause. Continued flow of blood into the auricles and ventricles, followed by contraction of the auricles aud full distention of the ventricles; the semilunar valves being closed and the auriculo-ventricular valves open.

Respecting the causation of the heart's sounds many opinions have been advanced. It has been well stated by Sansom that the heart sounds do not possess the character of musical tones, but that the special elements are, in the first sound prolongation, in the second tension. The special feature of the second, to which he directs attention, he says must be due to the suddenly developed tension of the semilunar valves of the pulmonary artery and aorta, and in some degree to the tension of the neighboring arterial walls. The second sound takes place just at the moment when the valves just mentioned are closed by the retrograde current of blood in the arteries produced by the elasticity of the walls of those vessels, and has been prevented by experimental procedures which preclude the possibility of such closure. A study of the causes of the first sound unfolds a more complicated problem. This sound has been shown, especially by Wintrich, to be compound in character, being composed, first, of a note short in duration, high in pitch, and due to the sudden tension of the auriculo-ventricular valves; and secondly, of a lower pitched and prolonged continued sound due to the contraction of the heart muscle. The tension sound is believed to be intensified by the tension of the ventricular walls, this being within certain limits greater the thinner the cardiac walls; and also by the opening semilunar valves, which are brought into sudden contact with the arterial walls, and by the

tension communicated to the walls of the aorta and pulmonary artery by the injected blood current.

Innervation of the Heart.—The heart muscle is unlike the voluntary or striated muscular, and the involuntary or non-striated muscular tissue, in both structure and function. As compared with voluntary muscle its striations are less distinct, and its fibres branched and possessed of a central nucleus, but devoid of a sarcolemma. While the heart muscle is involuntary, its response to stimuli differs from that developed in voluntary muscle, especially in being slower and not developing a tetanic contraction from a series of stimuli. Still the precise nature of the cardiac contraction is yet a matter of doubt; *i. e.*, it is not known whether it is a single contraction, a peristalsis, or a tetanus.

The heart derives its nerve supply from two sources, the pneumogastric and the sympathetic nerves. However closely the movements of the heart may be controlled by efferent impulses emanating from the medulla, it has been demonstrated that they are not dependent entirely upon the central nervous system, but that they are due in a measure to a nervous mechanism situated within the walls of the organ and consisting of ganglionic centres associated by connecting fibres. That such ganglia are indispensable to rhythmical pulsations, as was at one time believed has been shown to be an error, for ventricles in which ganglia have not been discovered are capable of such action. There is evidence which renders it presumable that the muscular fibres are not as sensitive to stimuli as are the contained ganglia, and that the latter are under ordinary circumstances a factor in the production of rhythmical contractions. The familiar fact that the frog's heart beats for some minutes after its removal from the body, and that contractions of the same may be re-excited by appropriate stimuli for a period of several hours, is corroborative of the above statements. Sufficient observations of the human heart have been made to prove that its physiology approximates that observed in other mammalia.

Efferent impulses pass to the heart from the medulla by way of the vagus and the sympathetic. Stimulation of the former slows the heart, and if continued too long, causes that organ to stop in diastole. The oft-quoted fact of Czermak's ability to arrest the action of his heart by compression of one pneumogastric nerve between his fingers and an osseous tumor upon one of the vertebræ, is a remarkable illustration. The inhibitory action of the vagus has been established beyond question. Experiments, especially those made with poisons, suggest that the vagi act through certain intracardiac ganglia, which are consequently called inhibitory ganglia. The sympathetic fibres, which come from the upper thoracic and cervical portions of the spinal cord by the way of the first thoracic ganglion, possess an opposite influence; for they, if stimulated, accelerate the heart's action, but do not increase the strength of its contractions. Our knowledge of

the physiology of the accelerator nerves is by no means as complete as is that relating to the inhibitory apparatus.

The heart's rapidity and force depend in some degree upon influences which originate outside of the nervous system. Examples of this are found in an inadequate supply of good blood to the cardiac muscle, which is largely dependent upon a normal condition of the coronary arteries. The quantity of blood upon which the heart contracts is by no means without influence; an excess stimulates to greater effort, but, when carried to the extent of inordinate distention, to enfeeblement. If the pressure upon the exterior of the heart is materially altered, as in pericardial effusion, there results incomplete cardiac action, which may be so great as to amount to actual cessation.

The Arterial Pulse.—A study of the pulse constitutes one of the most important acts in clinical investigations, so much so indeed that no case record is complete that does not detail the departures of this phenomenon from the normal. The arterial pulse results from the intermitting pressure exercised upon the blood current within the arteries by the contractions of the left ventricle. Each pulsation represents a ventricular contraction. In disease, however, all ventricular contractions may not be represented by a pulse beat, for certain ones may be too feeble to excite a pulse wave at a distance from the heart. Examination of the pulse gives the impression of a wave of blood expanding in the arterial tube and excited by the injection of a quantity of the same by the left ventricle. The element of expansion, however, is more apparent than real; for in order to take the pulse we must first compress it between the fingertips and a hard background, the result of this procedure being a flattening of the arterial tube between the pulse waves, the circular form of the vessel being restored at each ventricular contraction. Examination of the pulse is made by means of the tips of the fingers applied to some superficial artery, usually the radial, or by means of the instrument called the sphygmograph. These examinations teach us the frequency and strength of the heart's action, as well as the condition of the walls of the artery examined, the degree of arterial tension, etc. The fascination attendant upon the use of so many perfected instruments of precision creates a tendency to the neglect of the more common-place examination of the pulse by the sense of touch. Frequency, intermittency and gross changes in force are quite readily determined; but a careful estimate of the duration of the pulse-wave elevations, of the degree of arterial tension, especially between the pulse waves, of the several waves as to relative force and orderly succession, and the detection of dicrotism, is not so simple. Certain features of the pulse require a few words of explanation.

Frequency of the Pulse. Even in the healthy the pulse-frequency presents marked departures from the normal standard, age and personal idiosyncrasy being especially important in bringing about

this result. The ordinary frequency of the pulse is stated as 72 per minute. In infancy it ranges from 120 to 130 per minute. With the failing powers of old age it may again become more frequent. Abnormal frequency is said to exist in the adult when the pulse runs over 80. Rates of more than 200 are occasionally observed, but must be regarded as always pathological. Some few persons, apparently in the possession of excellent health, exhibit an habitual abnormal frequency, but the excessive rate is rarely a high one. Abnormal frequency as a result of disease is found in numerous nervous and febrile affections and in conditions of debility. It is also a prominent feature of exophthalmic goitre and other cardiac disturbances.

Infrequency is said to exist if the pulse of an adult runs much below 70. A pulse ranging between 40 and 50 is not of unusual occurrence. Like the rapid pulse, a slow rate may be pathological. It is sometimes present in cerebral lesions, jaundice, in conditions associated with increased arterial tension, and during convalescence from acute affections, after labor, and in fatty heart.

Volume of the Pulse. The fulness or volume of the pulse is influenced by a variety of conditions, but especially by the amount of blood in the circulatory system, the capacity of the left ventricle, the time occupied by the ventricle in emptying itself, the amount of blood in the arteries, and the condition of the arterial walls. The condition of the arteries and of the blood pressure has been duly appreciated only of late years. Normally the bloodvessels contain a quantity of blood sufficient to exert a distending influence upon their walls. The tension of the arteries is due to the slow unloading into the capillaries, the elasticity of the arteries, the forcible entry of blood, and the operation of vaso-motor forces. These are the factors which maintain the blood pressure, a proper degree of which is essential to life. The maximum tension occurs with the pulse wave at its height, the minimum tension just before the rise of the pulse wave.

Intra-arterial tension may be altered either in the direction of increase or decrease, giving rise to high and low tension respectively. High tension is characterized by a long wave well sustained. It is excited usually by an increase in the peripheral resistance of the capillaries and arterioles. Obstruction in the latter occurs in conjunction with pyrexia and various cerebral and spinal cord affections; resistance in the capillaries is observed especially during the course of renal affections and arterio-sclerosis. High tension may be a physiological condition in certain individuals, and has been observed as a family idiosyncrasy. It is usually accompanied by a slow, forcible pulse, the innervation of the heart being such that with a rise of blood pressure, due to peripheral resistance, the cardio-inhibitory centre is stimulated by the pressure. High tension is found associated with Bright's disease and various affec-

tions characterized by the presence of irritants in the blood, *e.g.*, gout, and chronic lead poisoning. It is present in some cases of anæmia, plethora, pregnancy and many chronic lesions.

A low tension is found especially in fevers, various debilitated states, and cardiac degenerations. It may be physiological. The pulse possesses certain peculiarities growing out of the relative duration and character of its rise and fall. If the rise is sudden, the pulse is said to be quick; if this quality is exaggerated, it is called bounding. If the vessels are over-distended or inelastic, the rise is slow and we speak of the pulse as sluggish. If between the points of highest and lowest tension the finger feels a little wave the pulse is said to be dicrotic. This phenomenon is due in all probability to a recoil from the closed and tense semilunar valves. It appears to be peculiar to tension.

PHYSICAL EXAMINATION OF THE CIRCULATORY ORGANS.

Heart.—This organ is interrogated by means of sight, touch, percussion, and auscultation. The investigation should be pursued in the order indicated. It is of the first importance that the examiner should divest himself of any preconceived ideas he may have formed as to the condition of the organ he is about to examine, and proceed methodically in every case, noting mentally, or, far better, upon paper, the variations from the normal which he discovers in connection with each step. Attention should be given to one method only at a time, centering the attention upon each feature of the examination as if it were of more importance than any other. The examiner should also come to a conclusion, if possible, regarding each point in the examination before proceeding to another, and, as already suggested, note the same in writing. Considerable experience with students of medicine and young practitioners has led the author to the belief that there is a tendency to the formation of opinions which are supported by an unconscious warping of the facts, the result of a want of order in physical examination, and a failure to reach a conclusion and at once record the result of each step as it is attained.

Inspection. A careful inspection of the cardiac region affords most valuable evidence, but is the method of physical examination which is most neglected. The chest should be bared and the patient placed in a good light. To secure accurate information by this method it is essential to become perfectly familiar with the topography of the chest's surface in order to readily note the relationship to superficial landmarks by all the methods of physical examination, including inspection, percussion, auscultation, etc. The relationship of the intra-thoracic organs to the bony walls of the chest has been already considered. It now remains to speak of the method of picking out the more important ribs and interspaces. This is most conveniently done by placing the hand upon

the chest with the little finger in the first intercostal space, when the remaining fingers will readily pick out the second, third, and fourth spaces, with the thumb resting in the fifth, which upon the left side will represent the position of the apex beat if the heart is in normal position. The determination of the point at which the heart impinges against the chest walls is the most important piece of information to be derived by palpation and inspection. It locates the position of the organ, and moreover gives important information concerning the condition of its muscular substance, for not only the position of the apex beat, but its force also must be noted. Position influences the observed signs quite materially. Thus the apex beat may be somewhat elevated when the patient is lying, especially if the diaphragm is forced upward by accumulations of flatus or ascitic fluid. Displacement of the impulse to the left results from hypertrophy of the ventricles, accumulations of fluid or air in the right pleural sac, or tumors of the right chest or mediastinum. Similar morbid changes in the left chest may displace the heart to the right, in extreme cases even to the right of the sternum. It must be borne in mind that in cases of normal transposition of the viscera, the apex beat is found normally on the right side in the fifth interspace.

If the impulse is abnormally diffused the apex is represented by a line drawn vertically through the point of most distinct impulse which is located furthest to the left. In the normal state, with the patient lying, the apex beat may be invisible, or if visible, it may be limited to but a small area. In thin persons, it may be seen over a larger area than normal, indeed as high as the fourth interspace as well as in the fifth. Pulsations are not normally present in the epigastrium. Abnormal prominence of the præcordium is unusual in adults. It may result, however, from long-continued violent action of the heart in young subjects with elastic chest walls, and especially those of a rachitic constitution. Effusion into the pericardium may also produce the same phenomenon, in this case the intercostal spaces being widened and bulging.

The area of impulse may be temporarily increased by mental excitement or physical exertion, and permanently by hypertrophy or dilatation of the heart or retraction of the left lung. When due to the latter condition the impulse may be observed as high as the third interspace.

The area of impulse may be lessened or obliterated as the result of the accumulation of adipose tissue, from simple weakness of the heart attendant upon acute or chronic disease, from overlapping emphysematous lung or from pleural effusion. Pericardial accumulation enfeebles, and later eliminates the apex beat.

Displacement of the area of impulse may be due to fluid or air in the pleural cavities, pleural effusion producing the most extreme displace-

ment met under any circumstances. If the accumulation is in the left pleural sac the heart's pulsations may be visible, even beyond the right nipple line; if upon the right side, the heart's apex may be carried to or beyond the left axillary line. Free pericardial effusion, if uncomplicated, raises the apex beat and removes it to the left. Aneurism of the ascending aorta may move the heart downward, and the apex beat is also displaced by any lesion which depresses or elevates the diaphragm.

Palpation is the handmaiden of inspection, for it is at once employed to confirm what has been learned by vision. Palpation, however, gives new information. It estimates the force of the heart's impulse, and detects morbid impulses, which may be of the nature of a vibration or a thrill. As the impulse indicates the beginning of the ventricular contraction it is of value in determining the rhythm of cardiac murmurs.

The heart's impulse may be increased or diminished in force. An increase of force, not due to temporary excitement, is generally dependent upon hypertrophy, the increase being in direct proportion to the degree of enlargement present, if dilatation and mural degeneration are absent. If the left ventricle is especially involved, the impulse is powerful and extends downward and to the left, occupying the sixth, seventh or eighth intercostal space. The force of the impulse is expended in the line of the longitudinal axis of the heart; whereas, if the right ventricle is mainly attacked, the increase of impulse will be more especially transverse and will extend downward in the line of the sternum, often involving the epigastrium. If the increase in area is out of proportion to the increase in force, the evidence is in favor of dilated heart, and the cardiac impulse conveys the impression of weakness. As hypertrophy and dilatation are usually combined, it often requires a careful estimate of the physical signs and symptoms to determine the relative proportion of each factor. The purer the hypertrophy, the greater is the increase in the heart's force, until, in typical cases, the maxium degree of heart power is reached. With the supervention of dilatation the impulse is gradually weakened and the area of impulse increased, until in cases of marked dilatation the force of the beat is reduced to a minimum, notwithstanding its increase in area.

Palpation also detects adventitious impulses, *e. g.* (1) in the form of a thrill dependent upon valvular disease and therefore associated with endocardial murmurs; and (2) as exocardial friction fremitus. Those due to endocardial disease have been called *fremissement cataire* (Laennec). These sensations communicated to the examining hand may be felt during any portion of the cardiac cycle. I cannot, in closing the subject of palpation, impress too strongly upon the reader its importance, for it is truly surprising to note how much information the expert will obtain by simply applying the hand to the præcordium.

Percussion. The superficial and deep cardiac spaces may be deter-

mined by percussion. For the former it is only necessary to outline the receding anterior border of the left lung, which is marked by a beginning resonance to the left of the area of cardiac dulness. It may also be defined by observation of the vocal resonance, which disappears at the edge of the lung. The deeper cardiac space is marked out by light percussion, which yields slight but appreciable dulness. Considering first the superficial cardiac area of dulness, it may be noted that it is modified by affections of the pulmonary structure of such a nature as alter the bulk of the lungs, viz., emphysema, collapse, fibroid disease, etc. As causes of an increased area of dulness, hypertrophy and dilatation rank first. The directions of increase have been considered. A rapid and easy method of determining enlargement of the heart is by percussing in a vertical line at the left of the sternum (to avoid the great vessels), and horizontally along the inferior border of the fourth rib. An increased area of dulness, due to fluid in the pericardium, presents a cone-shape, with the apex above. The lungs may be pressed apart by a large accumulation, and the dulness be increased above the base of the heart, and to the *left of the apex beat.*

It must be remembered that dulness varies in *quality* in different individuals. This is due to the amount of fat, and the condition of the bony framework. The importance of judging of the degree of dulness by comparison of the note elicited with one developed at a corresponding point upon the opposite side of the chest is apparent. The degree of resistance should be considered. This is determined by the amount of yielding of the parieties under the stroke of the plessor, as well as by pressure with the fingers.

Auscultation. A systematic study of the normal heart sounds must precede a satisfactory practice of auscultation. The location of the various valves has been considered, but it may be stated in short, in this place, that they are all intersected by a line drawn from the upper edge of the left third costal cartilage at its junction with the sternum, to the right fourth interspace near the sternum. While endocardial murmurs are all produced within an area of much less than an inch, they are conducted to and heard most distinctly at points upon the surface of the chest which are in some instances at quite a distance from the valve —*e. g.*, mitral murmurs are heard best at the heart's apex; aortic murmurs in the right second interspace near to the sternum, or over the right second costal cartilage; tricuspid murmurs over the lower extremity of the sternum; and those developed at the pulmonary valve, in the left second intercostal space at the sternal edge.

The heart sounds should be studied both in respect to amount or quantity, and character. Both sounds are increased from excitement or exertion, particularly in young persons with thin elastic chest walls. In these cases there is a parallelism existing between the increase in the

sound and in the impulse, whereas in structural disease of the heart—*e. g.*, hypertrophy—one sound is influenced more than the other. Changes in the quantity of the second sound are also readily detected, and by comparison of the aortic and pulmonary second sounds, one of these may be found to preponderate. As these sounds are normally of nearly the same intensity, an excess of one indicates hypertrophy of the related ventricle, such hypertrophy being due to obstruction. The cause of the obstruction is the actual factor in the production of the accentuation.

The influence of pulmonary disease and affections of the mitral valve in the production of hypertrophy of the right ventricle, increased pulmonary tension, and accentuation of the pulmonic second sound, and of chronic nephritis in the development of hypertrophy of the left ventricle, increased tension of the systemic vessels, and accentuation of the aortic second sound, are well known.

The quantity is diminished in all conditions of debility, the depreciation in power being more pronounced in the first sound. When both sounds are impaired, it suggests the interposition of some substance between the heart and the ear of the examiner, and this may be unusually thick muscular parietes, accumulations of fat upon the surface of the chest, or pericardial effusion.

For a study of alteration in the character of the heart's sounds, and a consideration of cardiac murmurs, the reader is referred to the section upon valvular disease.

The Sphygmograph and its Uses.—While not recommending the sphygmograph as a necessary part of a clinician's outfit, I must speak very favorably of its use in practice. It is true that the educated touch can discern nearly all of the information of which this instrument is capable, but then very few physicians ever attain such skill, and even then only after years of study and practice. The main objection to its use, advanced by the busy practitioner, is "lack of time;" an objection that has no foundation in the application of Dudgeon's sphygmograph.

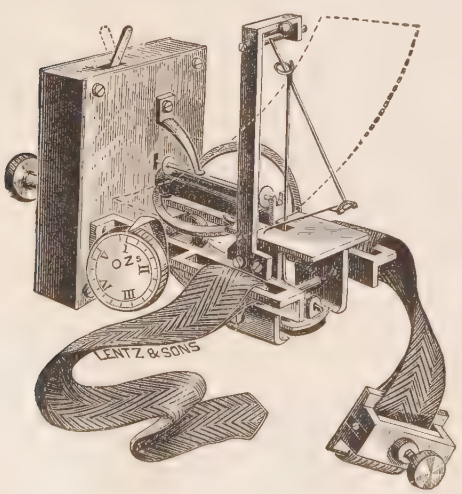


FIG. 1.—DUDGEON'S SPHYGMOGRAPH.

Several sphygmographs have been before the profession for a number of years, those of Marey, Pond and Dudgeon having been received with most favor. Of these the latter is the only one that can possibly be used satisfactorily, because it is accurate in the information it gives, occupies such small

bulk as to be portable, and its mechanism is so simple that it is readily applied, and can be repaired by any watchmaker. It is the invention of Dr. R. E. Dudgeon, the honorary president of the World's Homœopathic Congress of 1891.

Successful tracings made by this, as by all other sphygmographs, depend in great measure upon the skill of the observer. Careful attention to detail in its application is, therefore, necessary. Either arm may be selected for examination. It is important that the wrist be thoroughly bared, and that the clothing does not bind at any portion of the limb. It is well to have the elbow rest easily on the edge of a desk. The first step in the adjustment of the instrument consists in applying the metal button, which works the writing lever, accurately over the radial artery, a procedure that sometimes requires more knack than at first sight seems necessary. The novice will do well if he first determines the position of the artery by touch, and then with an aniline pencil, marks lines on each side of it. He now has the spot on which the button is to go accurately delineated. The instrument is next placed *in situ*, the box containing the clockwork resting upon the elbow side. The strap by which the instrument is held in place is then tightened, and when it is found that the writing lever is working well, secured. Most books teach that the strap should be tightened to a degree which will give the most marked movements of the lever. This is a mistake, for the most information can only be obtained from tracings taken under different degrees of pressure. My advice is to start with the minimum pressure that will give characteristic pulse tracings. Then, without removing the instrument from its position, subsequent tracings under heavier pressures can be taken simply by regulating the lever attached to an eccentric. It is generally best to take four tracings. The patient's fingers should be slightly flexed. Whether or not the hand should be extended at the wrist will depend very much upon the amplitude of the movements of the needle. I would say that that degree of extension which will secure the most marked movements is the one to adopt. The position of the hand, however, has considerable to do with the portion of the paper on which the lever writes. Sometimes the needle does not reach sufficiently far on to the paper to give a complete tracing, in which case the difficulty may be readily obviated by extending the hand at the wrist.

Next, the slips of prepared paper are placed between the rollers of the instrument, the clockwork started, and the tracing is made.

The Preparation of the Paper. For taking the tracing slips of smoked paper are required. These are about six inches in length and about fifteen-sixteenths of an inch in width. The paper selected should have a hard, smooth finish. The edges of the slips should be perfectly true, otherwise they will not follow a straight course in passing through the instrument, and the tracing will suffer in accuracy. To prepare the

papers for use, they are smoked over a small piece of burning camphor, a piece of tin for holding them during this process coming with each instrument. The tracing taken, it should at once be marked with the name of the patient and the date of the observation. To preserve it, it should be treated with a rapidly-drying varnish. For this purpose employ a half-pint wide-mouth bottle containing a saturated solution of gum damar in equal parts of gasoline and benzine. Into this dip the tracing, removing it at once, and laying it aside to dry. In the course of two or three minutes it can be put away or pasted in one's record-book.

The Advantages of the Sphygmograph. The most important advantage to be gained by the use of the sphygmograph is, that when used in conjunction with the sense of touch it teaches the fingers how and what to feel. It also puts the character of the pulse on record, and makes possible accurate comparisons of its condition from day to day. It shows at a glance the force of the heart-beats, readily discloses the slightest arrythmia, discovers the state of vascular tension, and, when taken in conjunction with other physical evidences of disease, aids in determining the condition of the bloodvessels, the state of the peripheral circulation, and, in some cases, assists in the diagnosis of valvular diseases of the heart.

The Normal Sphygmographic Tracing. The features of the normal pulse curve are given in the accompanying figure (Fig. 2), which is taken from Sansom's admirable work on the heart and aorta. The first portion of the curve (*ab*) is variously designated the "upstroke," the "percussion stroke," etc. It is nearly vertical and corresponds to the rapid distention of the artery which attends the entrance of the blood expelled by the contraction of the left ventricle. The nature of the mechanism employed for tracing the pulse is such that the lever does not accurately follow the changes in the artery, being, in this first step of the sphygmogram, tossed too high and followed by a sudden descent, thus forming the acute angle (*abc*). This rapid fall

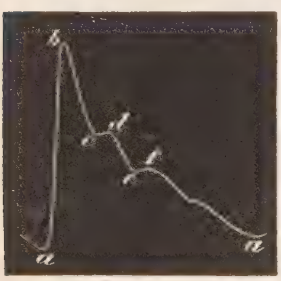


Fig. 2.—Typical Pulse Wave. (After Sansom.)

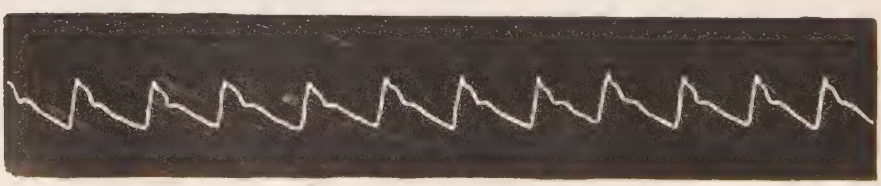


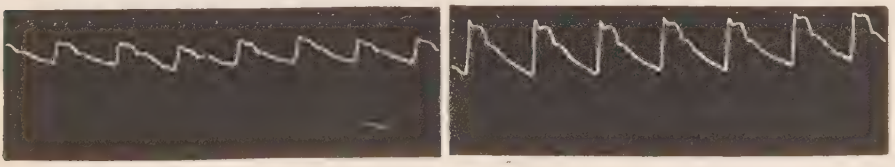
Fig. 3.—Normal Pulse Tracing.

continues until the part of the instrument in contact with the artery is again caught by the still swelling vessel when the tracing lever again ascends, forming the second or tidal wave (*cde*). The first wave (*abc*) is known as the "primary" or "summit wave." The summit and tidal waves are in reality one, and would so appear were the lever to actually follow the movement of the artery. The succeeding wave on the down-stroke is designated the "dicrotic" wave, and has received a variety of explanations. That which attributes it to the rebound at the time of the closure of the aortic valves seems to be more generally accepted than any other.

The different events taking place during the course of the tracing may be thus summarized: (*abcd*) the ventricular systole; the notch at *e*, generally known as the aortic notch, marks the time of closure of the aortic valves; (*efg*), the ventricular diastole.

Alterations in the "Upstroke," or Percussion Stroke. The alterations in the up-stroke consist in changes pertaining to its amplitude, its obliquity and its freedom from breaks. The amplitude of the stroke varies within considerable limits in health. Its height depends upon the suddenness of the contraction of the left ventricle and the volume of blood expelled at each systole. Increased obliquity of the up-stroke indicates labored or weak action of the left ventricle, or obstruction to the onward flow of blood either at the aortic orifice, or in one of the blood-vessels. It is observed under normal conditions when a considerable deposit of subcutaneous fat intervenes between the artery and the button of the sphygmograph. When the obliquity persists under different degrees of pressure, weakness of the left ventricle is indicated.

Sphygmographic Evidence of Increased Arterial Tension. In high arterial tension the vessels are maintained in a distended condition longer than normal, the systole of the left ventricle being prolonged. This is exhibited in the sphygmographic tracing by a broad flat summit wave. The dicrotic wave is less marked than normal and may even be



a *b*

Fig. 4.—Pulse of Prolonged Tension. In *b* the Increased Height of the Curve under Greater Pressure than in *a* is well Shown.

effaced. It occupies a relatively high position on the down-stroke of the tracing, which, by the way, has a gradual slope. Alterations in the degree of pressure show that the maximum tracings are obtained as the pressure is increased. The amplitude of the tense pulse is not great unless the quantity of blood in circulation is large. In some cases the pulse

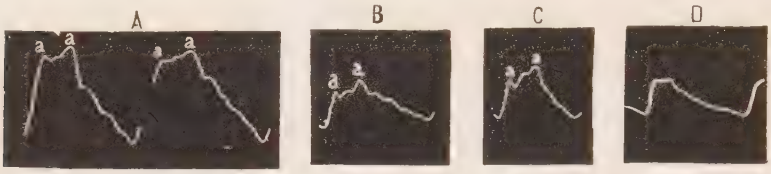


FIG. 5.—ANACROTIC PULSE. (After Landois & Sterling.)

is anacrotic, a condition in which the summit is broad and flat, but slopes upward from the top of the up-stroke. Sometimes there is a slight notch between the cessation of the up-stroke and the beginning of the summit wave. The anacrotic pulse is observed also in aortic stenosis and in the arteries of paralyzed limbs. It has been observed in health

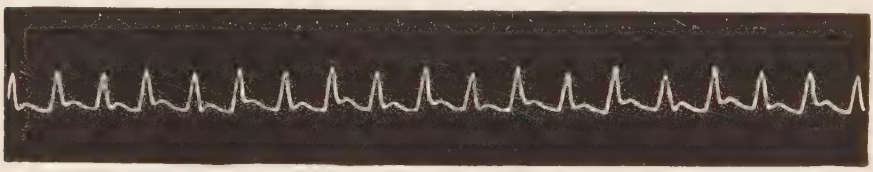


FIG. 6.—PULSE OF LOW TENSION.

after a cold bath. To use the words of Sansom: "It indicates the prolonged effort of the left ventricle against an obstruction, but it rather shows that the ventricle is equal to the increased labor. When the ventricle fails the bulging of the tidal wave is no longer observed, the sum-



FIG. 7.—DICROTIC PULSE, IN PATIENT CONVALESCENT FROM TYPHOID FEVER.

mit of the trace becomes flat and dicrotism, which we consider to have an unfavorable significance, may be manifested."

SPHYGMOGRAPHIC EVIDENCE OF LOW ARTERIAL TENSION. Naturally the conditions observed in low arterial tension are the reverse of those described as belonging to heightened tension. The summit wave forms

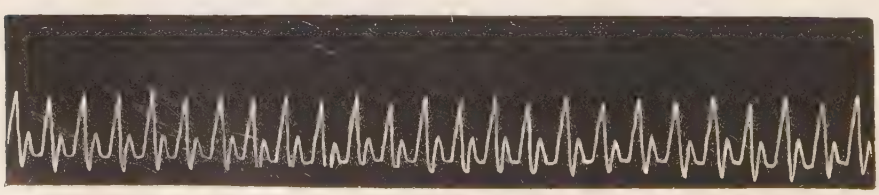
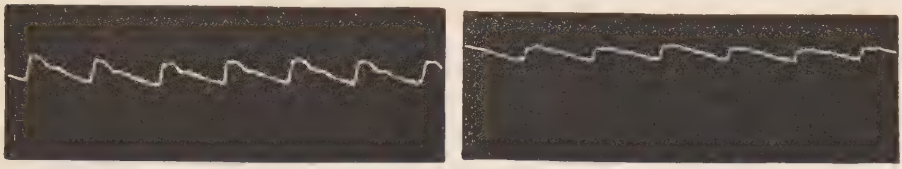


FIG. 8.—HYPERDICROTIC PULSE.

an acute angle ; the dicrotic wave is prominent and occupies a low position on the down-stroke, in some cases even being so low and so well marked as to make the pulse appear almost like an alternation of strong and weak beats. The maximum tracings are obtained under low degrees of pressure with the instrument.



a *b*

FIG. 9.—SHOWING DIFFERENCES IN PULSE TRACINGS IN A CASE OF BRACHIAL NEURALGIA. *a*. TRACING OF THE RIGHT RADIAL PULSE. *b*. TRACING OF THE LEFT RADIAL PULSE (AFFECTED SIDE).

The sphygmographic evidences of arrhythmia, slow pulse, palpitation, tachycardia, and valvular diseases will be described in the sections devoted to the consideration of these troubles.

THERAPEUTICS OF CARDIAC AFFECTIONS.

In beginning the treatment of cardiac derangements, and especially that of chronic lesions, it is well to determine *a priori* what degree of success can be reasonably expected from the application of therapeutic measures. It is also important to make an estimate of the degree of improvement which may be expected within a given time, or anxiety for the welfare of the patient may lead to changes in the treatment with unnecessary frequency,—a very common error in the treatment of diseases of the heart. In many affections of this organ, and these constitute a large percentage of cardiac and cardio-vascular affections, it is only possible to relieve symptoms and prolong life for a greater or less length of time; while in others, rigid adherence to correct principles of treatment may result in apparent or complete restoration of the integrity of the organ.

Before prescribing medicines for affections of the circulatory system, the habits of the patient as to eating, exercise, rest, etc., should be determined, also the degree of addiction to tobacco, alcoholic beverages, coffee, tea and other substances having a known influence upon the heart and bloodvessels. It is also important for prognostic and therapeutic reasons to carefully determine the nature and extent of associated lesions, especially such as involve the lungs. Aside from homœopathic treatment, certain adjuvants are of value in occasional cases. Failing circulation so commonly designated "heart failure" is one of the most frequent conditions we are called upon to treat in association with chronic heart lesions, as well as in acute febrile diseases. The measures adopted

for the control of the primary affections are the essential ones for strengthening the enfeebled heart. We are nevertheless frequently obliged to prescribe directly for the relief of the cardiac weakness, ignoring in some degree, measures of treatment of a more radical sort. Various remedies, especially *arsenicum, cactus, convallaria, digitalis, kalmia, lilium tigrinum, spigelia,* etc., are valuable for weak heart, but for a limited period of time must, in occasional instances, be replaced or supplemented by agents which have a most *positive* and *immediate* influence upon the heart's power. *Alcohol* is perhaps the most important of this class of remedies. It possesses the further advantage of being in some degree a food, as well as stimulating the digestive process. Unless urgency is great, it should always be prescribed with the food. Wine, whisky and brandy are most employed. The stronger alcoholics, and champagne, are preferred for very rapid circulatory failure such as exists in collapse. Alcoholics should always be prescribed upon indications, their influence carefully noted, and the dosage regulated accordingly. The hypodermatic injection of whiskey or brandy is admissible when the symptoms are of a most urgent character. Applications of heat, dry or moist,—in the form of the general or local bath, hot water bottles and bags, and still more important, the direct application of heat or of irritants such as a large mustard plaster to the region of the heart, frictions or flagellations of the præcordium, inhalations of ammonia, general frictions, transfusion of blood or the injection of the normal saline solution, inhalation of nitrite of amyl, and hypodermatic administration of ether, or nitro-glycerin—all stimulate the heart to greater activity and are occasionally useful. Their action is but transitory. The drugs being quickly eliminated, are available only when rapid and temporary action is desirable. While nitro-glycerin is rapid in its action, it is better adapted to prolonged administration than are many of the foregoing. At the head of the cardiac tonics stands *digitalis,* a most valuable drug, but greatly abused by reason of its frequently favorable action in a certain class of cases characterized by organic weakness of the heart walls. From three to ten or more minims of the tincture are given several times in the course of the twenty-four hours to secure its physiological effect. It is pre-eminently indicated in dilatation of the heart when the action of that organ is feeble, rapid, and disturbed in rhythm. Belonging to the same class are *agaricin, strophanthus, convallaria, adonis vernalis, sulphate of sparteine, caffeine,* and *strychnia.*

At the present time *strychnia* is attaining great popularity as a remedy for failing heart in acute disease and is usually administered hypodermatically in doses of from one-hundredth to one-fiftieth of a grain. Its value in some cases of pneumonia and typhoid fever is undoubted.

Remedies which depress the heart's action are but rarely useful. In

this class may be mentioned *aconite* and *veratrum viride* as the most prominent. Tartar emetic and hydrocyanic acid are rarely used at the present time. Bloodletting is still considerably employed by the old school, but is of most doubtful ultimate utility.

Remedies acting upon the bloodvessels. The most valuable agents under this head are *such drugs as dilate the arteries*, this being a feature of the so-called vascular stimulants. The dilating influence of some drugs is very rapid and pronounced, particularly is this true of *nitrite of amyl* and *nitro-glycerin*. Other nitrites exert the same action, but to a minor degree. *Belladonna* and its alkaloid *atropine* are also prominent members of this group, but acting more especially upon the peripheral vessels. *Heat*, locally or generally applied, also increases the lumen of the arteries. The advantage to be gained from the use of these drugs is that they enable the weakened heart to act to better advantage under decreased peripheral resistance.

Contraction of the arteries follows upon the application of *cold* or the administration of *ergot*, *ergotine*, *hydrastis*, *hydrastinine hydrochlorate*, *hamamelis* and *strychnine*.

Cardiac remedies.—In the following pages will be presented a short rehearsal of the indication for the more important heart remedies. No attempt will be made to completeness, the idea being to present merely a concise *résumé* of the subject. The more important medicines for the weak heart are:

Digitalis, which is so much used in cases of weak heart for its physiological influence that there is a tendency to overlook it as a remedy prescribed strictly on symptomatic indications. Baehr lauded it for the less intense forms of rheumatic inflammation, especially pericarditis, and other observers have corroborated his observations; but I have not been able to satisfy myself that it exercises a decided influence over inflammatory action. It has appeared useful in pericarditis in the stage of liquid effusion, *i. e.*, after the heart has become oppressed, and from the beginning of the attack in some subacute cases. For dropsy of the pericardium it may be effectual, but usually in the form of the infusion given in diuretic doses. It sometimes mitigates the symptoms of the "gouty" or "fibroid" heart, and is useful in dilated heart even when prescribed in small doses. The pulse is small, weak, disturbed in rhythm, and may be intermitting. There is a faint hollow feeling in the epigastrium and sensations in the cardiac region causing anxiety. The breathing is oppressed, with a feeling of inability to fill the lungs with air. There may be weakness and heaviness of the left arm, and the skin is often cyanotic.

Cactus grandiflorus is applicable mainly to organic affections of the heart. It is often an admirable "heart tonic" when given upon its indications and in minute doses, increasing the force and efficiency of the

ventricular contractions. It is not, however, useful even in a majority of the cases of weak heart. There is a tendency in the dominant school to look with disfavor upon remedies of this class, which do not improve the heart's strength in nearly all cases; but in the author's experience the most remarkable results in this line have been attained by the use of medicines which in the frequency of their favorable action cannot compare with digitalis, which is by common consent recognized as the type. The sensation of constriction "as if the heart were squeezed by a hand" is the most important subjective symptom of cactus and may lead to its use also in functional disorders. It is also indicated by severe pain, which may be of a shooting character and attended by symptoms of circulatory failure, viz., feeble, small, intermittent pulse, cold sweat, etc. In the cases I have met, the pain has not been apparently due to inflammation. In myocarditis and acute valvular diseases, cactus has been of great service when there was general slight œdema, and a dusky color of the extremities. While the dilutions often afford relief, the best results have been obtained from the tincture in drop doses frequently repeated. Doses of five to ten drops of the tincture every three to six hours, give, in some instances, better results.

Strophanthus, while much used in the tincture, for weak heart is valuable also in smaller doses for the hypertrophied irritable heart with tense arteries and free discharge of clear urine.

Sparteine sulph. is admirably suited to the feeble heart, occasionally met in nervous or hysterical persons, unaccompanied by signs of valvular or indeed of organic trouble of any kind. Also for some cases of myocardial degeneration. In one case seen by the author, a neurotic lady 48 years of age who was passing through the climacteric period had been confined to her room for seven months. She had had alarming attacks of heart feebleness with apparent unconsciousness. The heart action was feeble, the pulse small. She entirely recovered. Another lady aged 46 years who had been subject to similar attacks for several years was promptly relieved and finally recovered. The first decimal trituration was administered four times daily in each instance.

Agaricin. The influence of this drug upon the heart was first made known by the author. It is a heart tonic of the highest order and has, in the hands of many observers, proven useful in dilatation of the heart associated with emphysema of the lungs. It has also given good results in the heart feebleness attendant upon acute infectious diseases, especially typhoid fever and pneumonia. The occurrence of profuse sweating strengthens the probability of a good result. Twitching of muscles is an invaluable indication. I have frequently observed good results in cases of weak heart, in elderly people, with arrhythmia, and an absence of valvular murmurs. The first decimal trituration has been employed in most instances.

Convallaria has been considerably employed for the feeble heart of chronic organic disease, but we have as yet no very positive indications for its use, as it has been used empirically, provings being but scanty. It seems to be of special value when there is a high degree of dyspnœa attending. My own results with this remedy have been best when prescribed for the dilated right heart consecutive to emphysema. Convallaria also proves valuable when a respiratory stimulant is required, which Hale has called attention to. This remedy is more efficient when given in the lower dilutions or in the tincture.

Caffeine. This agent has been employed almost exclusively for the control of acute heart failure, and is necessarily administered in doses of considerable size, viz., one to five or more grains. It is readily made soluble for hypodermatic use by employing an equal amount of salicylate of sodium.

Cocaine hydrochlorate. The author was one of the first to call attention to the value of this agent as a cardiac stimulant. It appears to be especially suitable for the cardiac failure attending infectious diseases. The occurrence of hiccough in the advanced stages of organic cardiac disease is a strong indication for cocaine. The first decimal trituration, in doses of two grains repeated every two to six hours, has given the best results.

Veratrum album is sometimes valuable for failing circulation of sudden onset occurring in the course of acute diseases and attended by collapsic phenomena. The small thready pulse, cool moist surface, sunken features, profound prostration, and in some cases vomiting, constitute a striking group of indications. Veratrum should always be given in small doses.

Valerianate of ammonia is of great value in the various functional disturbances of the heart, particularly when developing in hysterical individuals. I have witnessed prompt relief from the most violent cardiac pain, which had defied even large doses of morphia hypodermatically. In pain of a neuralgic character involving the heart, stomach or other viscera, this drug is one of the first to be considered if evidences of hysteria are present. Drop doses of a saturated alcoholic preparation may be repeated frequently. The valerianate of zinc acts similarly, but is better adapted to protracted administration.

Ignatia is useful in the functional disturbances of the heart often met in nervous and hysterical individuals, and especially if excited by grief or mental strain. It also sometimes relieves the symptoms attendant upon hypertrophy of the heart, especially if the subject is a nervous one.

Nux vomica is much employed on its general indications. It is seldom of value in organic affections. The patient manifests much irritability of mind as well as of body, expressed by oversensitiveness, fits of temper, etc. The digestion is attended by annoying symptoms, and the

bowels are constipated, although there is a sense of urging to stool. The urine may be passed often and in small quantities. Nux vomica relieves the palpitation and subjective symptoms of many dyspeptics and hypochondriacs, and is sometimes of use for the symptoms attendant upon hypertrophy. Palpitation due to overstudy, or a sedentary life, or which is related to the digestive process, may be helped by nux vomica.

Coffee has long been recommended for functional disorders of the heart; palpitation excited by emotional conditions. It is admissible for nervous, sensitive, excitable persons, who do not use coffee.

Lilium tigrinum is indicated in the palpitations, painful sensations, faintness, and other symptoms referred to the cardiac region by nervous females who are suffering from organic heart disease or uterine disease. The sphere of this medicine is emphatically the groups of symptoms complained of by neurotic women, such symptoms being, however, often present in association with organic heart disease. The sensation as if the heart were grasped in a vise (cactus) is a reliable indication for this remedy. I have usually employed the first decimal dilution.

Lycopus virginicus has been used in affections of the heart due to rheumatism, in hypertrophy, in Graves' disease, and in valvular affections accompanied by dyspnœa, palpitation, cough, feeble and arrhythmic pulse, cool extremities, nervousness, hæmoptysis with excitement of the heart and pain in the chest (also aconite).

Ferrum often acts favorably in the functional disorders attendant upon anæmia. The most important indication is vaso-motor irritability indicated by the ready flushing of the pale face. If dyspepsia with vomiting, or diarrhœa with undigested stools are present, the indications for ferrum are strengthened.

Cinchona is of value in some functional disturbances of the heart induced by anæmia, especially if the latter is the result of loss of blood or other fluids of the body.

At the head of the list of remedies for inflammatory affections of the heart must be placed:

Spigelia, which is pre-eminently valuable in the various forms of acute inflammatory affections of the heart, particularly those of rheumatic origin. It is occasionally indicated in valvular disease, especially if recently developed, if there is a good deal of oppression in breathing, palpitation and pain. The patient must lie with the head high and upon the right side or back. The pulse is rapid, feeble and may be disturbed in rhythm.

Bryonia does not appear to exert a special action upon the heart or its membranes, nevertheless it has been employed in inflammatory affections of the heart, more particularly of the pericardium, by reason of its general action upon serous membranes. It is applicable to active cases of pericarditis before the organ is oppressed by the liquid exudate. It is

best to discontinue it as soon as the pulse fails in force and regularity. Bryonia is of little value in serous effusion into the pericardium, and inflammations due to vitiated blood, but rather to the idiopathic and rheumatic varieties. Functional disturbance in the form of excited action, when associated with suppressed or vicarious menstruation, may yield to bryonia. The pulse is full and hard.

Squills. The provings of squills manifest a decided influence of this agent upon the heart. It is suited to inflammatory affections of this organ, and as well to inflammatory affections of the lungs and pleura. Clinically it proves valuable in combined inflammatory lesions of these organs. It should be administered, as a rule, in the dilutions only. I have used *scillitin* in the third decimal with considerable satisfaction.

In the treatment of degeneration of the myocardium we most frequently turn to *arsenicum.* This great medicine has, however, been recommended in every variety of disease of the heart, both organic and inorganic, but it is in the structural affections that it is of most value, also in those conditions which, though recognized as of a functional nature, are in many instances, at least, dependent upon an organic basis. Some cases of palpitation associated with general indications for arsenic, as well as some neuralgic pains, are controlled by this drug. In chronic valvular lesions, in dilatation, and in weak heart due to whatever cause, it is one of the first remedies to be considered. It not infrequently gives favorable results after the failure of digitalis and related drugs to satisfactorily improve the heart power. In liquid exudation into the pericardium it is often indicated and clinically valuable. The pulse is small, feeble, and may be disturbed in rhythm. The patient is usually relieved by lying with the head high. The restlessness, anxiety, thirst, prostration, and nocturnal aggravation, characteristic of arsenic, are often attendant upon the heart disorders relieved by this medicine.

Aconite in small doses is an admirable remedy for the palpitation of neurotic individuals when induced by fright, emotional excitement, and exertion, especially walking against a cold wind. It also influences palpitation attendant upon inflammatory changes in the heart membranes, and the excessive action of hypertrophy. The pulse may be full, hard, and bounding, and the skin hot; or it may be small, and hard, and of high tension. In most cases in which aconite is useful there is restlessness, anxiety of mind, often with fear of death. There may be a sense of anxiety in the heart region. When the pulse has been small and feeble, and associated with collapsic symptoms, I have found the dilutions efficient, but larger doses are preferable when the pulse is full and bounding. In the incipiency of all heart inflammations it is indicated by much the same symptoms.

Veratrum viride is employed in the tincture for excessive, tumultuous action of a strong heart. There is hypertrophy or plethora.

Kalmia latifolia. This remedy, which received its greatest reputation from the commendation of Hering, has had but little use. I have employed it, but not sufficiently to permit of very positive statements. It has been given most frequently in valvular affections and in hypertrophy with slow pulse and pains upon the left side, also in various functional affections of the heart. It is to be considered also in heart troubles associated with albuminuria, intra-ocular inflammations, etc.

Iodide of arsenic. This compound of arsenic and iodine is pre-eminently valuable for the senile heart. The pathological condition is not always determinable, but the organ is usually somewhat enlarged, and does not work smoothly. It is evident that the heart as well as the arteries are in a degenerate state. The pulse is rather shotty and usually there is an absence of heart murmurs. Hurry, or ascending stairs causes shortness of breath and excited action of the heart, and slight anginal pains may be superadded. In some instances vesicular emphysema of the lungs is associated. From the second to the fourth decimal triturations should be employed.

Aurum muriaticum. One of our most useful remedies for the heart symptoms of neurasthenic individuals. The symptoms referable to the heart are often only a part of a long list of morbid sensations and mental symptoms, the entire group being controlled oftener by chloride of gold than by any other remedy. Gold is also to be considered for degeneration of the myocardium. I have seen some apparently good results in syphilitics and those suffering from general arterial degeneration. The second decimal dilution in five-drop doses is the best form for administration. It should be dropped into water at the time of taking. Triturations and pellets deteriorate rapidly.

Phosphorus was strongly recommended for cardiac inflammations by Baehr, who is supported by Hale; but the suggestion, if we are to judge by their verbiage, is theoretical, as they say nothing indicating that their statements are based upon practical experience. I have employed phosphorus much in the later stages of infectious diseases and during convalescence when the evidences of muscular degeneration are pronounced. It sometimes apparently improves the feeble heart under these circumstances. The pulse is feeble, compressible, and rapid. It is well suited to feeble persons with general tissue degeneration.

Diseases of the Pericardium.

PERICARDITIS.

The pericardium is the double membranous sac enclosing the heart. It is composed of an external fibrous layer, rich in elastic fibres, and an internal or serous layer. The visceral, inner, or serous layer, is thin; the parietal or fibrous comparatively thick. The former is separated from though intimately connected with the heart muscle by connective tissue, which is at times infiltrated with fat.

The pericardial sac itself is cone-shaped, its base resting upon the tendinous centre of the diaphragm, and its apex is behind the upper portion of the sternum. It is covered on either side by the pleura; only a small portion of it is in contact with the anterior surface of the chest, and that in the median line. The pericardial cavity invariably contains a small amount of alkaline fluid.

Definition.—Pericarditis is an inflammation of the pericardium.

Etiology.—Pericarditis is usually—future investigations may prove it to be always—a secondary affection. Foremost among the conditions to which it bears this relation is rheumatism, of which disease it must be regarded as one of the less frequent pathological features. Coming thus, it may complicate any period in the course of the disease, appearing even before the slightest evidence of joint mischief is manifested; indeed, a rheumatic pericarditis may set in without any of the ordinary symptoms of rheumatic fever. The frequency with which pericarditis complicates acute rheumatism is not placed at the same figure by all authorities, for various statistical tables from competent observers show that from 18 to 20 per cent. of all cases of rheumatic fever are associated with this disease. In a collection of 1,426 cases from various authors the percentage of pericarditis was 15.8. Sansom found pericarditis in 38 per cent. of the cases of acute rheumatism occurring in children, and in 35 per cent. of all cases exhibiting rheumatic phenomena. This authority observed that the disease in children is very liable to pass away without leaving a trace of its existence, although in the majority of other cases it is followed by marked adhesions and structural changes of the pericardium. Sibson found pericarditis in 63 out of 326 cases of rheumatism, a proportion which Pepper regards as below the average. The general trend of

statistics bearing on this point indicates that pericarditis is more frequently associated with rheumatic fever as the subjects of the latter disease are younger. It has also been noted that pericarditis is especially liable to occur in first attacks of rheumatism. It is also said that pericarditis may complicate certain other diseases inherent to the rheumatic constitution, *e. g.*, tonsillitis and chorea.

Pericarditis sometimes develops, though with far less frequency than in rheumatism, in certain of the infectious and constitutional diseases, notably in scarlet fever, measles, purpura hæmorrhagica, pyæmia, variola, influenza, croupous pneumonia and scurvy. It is said that it may also be associated with inflammatory processes in articulations, periosteum and bones.

Next in importance to rheumatism as a cause of pericarditis are Bright's diseases of the kidneys, especially that form known as acute parenchymatous nephritis. Pericarditis occurring as a complication of renal disease does not bear so close a relationship to the primary disorder as it does when it results from rheumatism. Occurring in the course of the latter, it is often an initial manifestation of the illness. Complicating the Bright's diseases, it more frequently arises later, and is often a fatal sign. Its onset is then obscure, subjective symptoms are slight, and its discovery must be made by the physical signs.

Many cases of pericarditis originate by extension from diseases of the pleura, of the lungs, of the mediastinum, or even from the valves and the myocardium. New growths involving adjacent organs may result in ulceration and perforation of the pericardium with consequent inflammation.

Involvement of the pericardium in tuberculous and carcinomatous processes, especially the former, is not a very unusual cause of inflammation of that membrane. Slev even takes the ground that tuberculosis is as frequent a cause of pericarditis as is rheumatism. However that may be, it is certain that many of the cases of pericarditis which are, during life, regarded as examples of primary disease are at the autopsy discovered to be of tuberculous origin. The usual infection comes by way of the mediastinal glands. In a few cases it forms part of a general tuberculosis of serous membranes. The diagnosis of tuberculous pericarditis is impossible in the absence of evidence of tuberculosis in other parts of the body. Hayem and Tissier believe that tubercular pericarditis results from extension by contact with a carious sternum or spinal column, or from tuberculosis of the bronchial glands or pleuræ. The possibility of a primary pericardial tuberculosis has been urged, but its existence has not been proven.

A traumatic pericarditis results from blows and punctured wounds, as from instruments or fractured ribs, as well as from the rupture of an abscess, cyst, or aneurism, into the pericardial sac.

When pericarditis apparently originates independently of the above or other recognized causes, the attack is designated idiopathic. Cold is the most prominent etiological factor of this group. "Idiopathic pericarditis" is, however, growing less frequent, as expert observation demonstrates more and more clearly the all but invariable presence of a primary causative affection.

Young and middle-aged subjects and those of the male sex are predisposed to the disease.

Some cases of pericarditis are of septic origin. Most of the cases occurring in young infants are believed to be of this character, the infection having been derived from the mother or from the umbilicus. Pneumococci have been demonstrated in the purulent effusion in several cases.

Pathology and Morbid Anatomy.—There is a close similarity between the changes found in pericarditis and those present in inflammation of the pleuræ and peritoneum. Essentially they are the same. The differences noted are especially the result of the influence of the peculiar movable organ contained within the inflamed membrane. First, a diffuse injection of the membrane is observed; exudation follows. The lymph usually appears first about the base of the heart, and may extend over both surfaces of the entire membrane. The well-known "shaggy" or "hairy" heart is due to the incessant contact and separation of the sticky surfaces.

A mild form, in which small patches of inflammation, followed by proliferation of the endothelium and connective tissue development, giving rise to "milky" or "pearly" spots, is recognized by some. Others deny the inflammatory origin of these changes. Between this mild form and the well-developed variety there are many gradations. As in other serous membrane inflammations, we recognize (1) a dry form—*i. e.*, a form in which there is a relative absence of the serous exudative element; (2) pericarditis with liquid exudate—*i. e.*, a form in which, in addition to more or less lymph, there is a predominance of serum (modifications of this form are those in which the fluid is purulent or bloody); (3) a chronic form with resulting adhesions—*i. e.*, adhesive pericarditis. Further consideration of pathological conditions will be mentioned in treating of the various forms of pericarditis.

Myocardial changes may accompany the pericardial inflammation. The effusion sometimes leads to hypertrophy, and sometimes to atrophy of the cardiac walls. Marked hypertrophy is especially liable to occur in adhesive pericarditis. Purulent pericarditis occasionally results from the rupture of a purulent collection in the myocardium.

(a) ACUTE DRY PERICARDITIS.

Acute dry pericarditis is usually a secondary affection. It is the simplest and least dangerous variety of inflammation of the pericardium.

Its especial anatomical feature is the great or entire predominance of the fibrous exudation. The extent and intensity of the process varies much. The membrane about the base of the heart, or even its entire surface, may be involved. The exudation itself may be so slight as to appear as a mere varnishing of the pericardial surface, or again, as almost sufficient to lead to a shaggy or honeycombed appearance. In severe cases the myocardium is involved to a considerable depth, the muscle fibres manifesting the evidence of inflammatory action. A small area of softening and purulent collection, independent of pyæmic origin, was present in one of my cases. Careful inspection of the pericardium after removal of the exudate may reveal tubercular granulations, tuberculosis being a common cause of this variety of pericarditis.

Clinical Course.—This form of the disease is often overlooked on account of its mildness, the symptoms of the primary affection predominating. The occasional discovery of pericardial adhesions at autopsies of persons who have never presented a history of pericarditis demonstrates this. Other cases present characteristic symptoms, but usually in a mild form. Pain, tenderness, palpitation, disturbances of the pulse and fever, are variously developed in intensity and relationship to each other. In severe cases the pain may be intense and even assume an anginal character. The temperature is then high, and the general symptoms correspondingly severe.

Diagnosis.—This must depend on the physical signs, the most important of which is the pericardial friction sound, the characteristics of which should be carefully studied. It may be described as double—*i. e.*, it is heard during both systole and diastole of the heart, and continues rather longer than the special sounds of that organ, and is not, as a rule, exactly synchronous with them. It may be confined to one of the heart sounds, or, in rare cases, it has been observed to be triple.

The Quality of the Sound. The pericardial murmur is a "to and fro" sound, or "a coming and going" sensation. It is usually harsh, rubbing, creaking or grating, although it may occasionally be soft, thus resembling an endocardial murmur. It is usually heard most distinctly over the right ventricle, which is the most exposed portion of the heart. In some instances, however, the point of greatest intensity is found over the base or along the left border of the sternum, or at the apex. It is apparently produced near to the surface of the chest, and can usually be intensified by pressure with the head or stethoscope on auscultation; change of position, especially from recumbence to sitting; and may be rendered somewhat louder during a held expiration. It is not always accurately related to the heart sounds, being sometimes omitted. The variability of the pericardial friction sound as to location of maximum intensity, and quality, its irregular presence—appearing and disappearing—the variable number of sounds, and the conditions

intensifying them, must be borne in mind. If valvular disease is co-existent, it may be difficult to differentiate endocardial from pericardial murmurs. The pericardial murmur is usually much the louder of the two. Paul asserts that the friction sound develops at the lower border of the heart and extends in area upwards until the whole pericardial triangle may be accurately mapped out by auscultation, and this with the eyes of the examiner closed. It, however, extends downward one and a half centimetres below the lower border of the sternum, on account of the conducting power of the liver. King Chambers mentions a very interesting way of distinguishing pericardial from endocardial murmurs. The stethoscope is placed over the point selected. The ear is gradually removed from it, while the observer carefully notes whether or not the murmur disappears before or with the regular heart sounds. Should the murmur be no longer heard, while the heart sounds are distinct, we may regard it as of pericardial origin. This sign is of considerable value, but too much importance must not be attached to it, as it may occasionally prove misleading.

Palpation often enables one to perceive the friction, especially if the patient is placed in a semi-recumbent position. It is most distinct over the right ventricle. This "friction fremitus" gives the examining hand the impression that it arises from close beneath the surface. It is limited in area to the part over which the impulse of the heart may be felt, and in duration, to the times of cardial movement.

Percussion rarely, if ever, gives evidence of value in pericarditis without liquid effusion.

Differential Diagnosis.—Osler calls attention to a case in which the double murmur of aortic incompetency simulated the "to and fro" pericardial rub; but, as he states, the direction of transmission of the murmur, the phenomena in the arteries, and the associated conditions, are sufficient to permit a ready decision. From pericarditis with effusion, it must be separated by the appearance of the physical signs indicative of the presence of fluid in the pericardium, for which the reader is referred to page 44.

Prognosis.—The prognosis is favorable as to life, but adhesions may result giving rise to subsequent trouble. Unfavorable cases usually pass on to a stage of liquid effusion, or a chronic form may result from simple plastic pleurisy, especially if the inflammation is tubercular in origin, resulting in great thickening and adhesions of the pericardial layers.

Of the various forms of pericarditis, the sero-fibrinous is the most important. Breitung, of Berlin, found that of 374 cases of pericarditis upon which autopsies were made at the Charité, there were of

Sero-fibrinous, 108.

Pericarditis with partial adhesion, 111.

Hæmorrhagic pericarditis, 30.
Purulent pericarditis, 24.
Secondary tubercular pericarditis, 24.
Primary tuberculous pericarditis, 2.
Pericarditis with total involvement of the sac, 73.
Pericarditis with ossification, 2.

(b) PERICARDITIS WITH LIQUID EXUDATE.

Morbid Anatomy.—This is a later stage of the dry form of pericarditis. While all cases of dry pericarditis are not succeeded by a stage of liquid exudation, all cases of pericarditis with exudation of this character must be preceded by some degree of dry pericarditis. The form of pericardial inflammation now under consideration is generally described by authors as the second stage of pericarditis, the dry form constituting the first stage. The frequent occurrence of dry pericarditis, or at least of a pericardial inflammation in which liquid exudation cannot be demonstrated, warrants the separate consideration of these forms. The exudate may be predominantly serous or sero-fibrinous, and this has led some authors to designate two varieties, (1) pericarditis with serous effusion, and (2) pericarditis with sero-fibrinous effusion. This is not a practical division from a clinical standpoint, for there is no sharp line of demarcation between the two, a series of cases presenting an insensible gradation from one form into the other. In either variety, but especially in the former, the admixture of pus may occur, leading to a sero-purulent accumulation. The effusion may also be practically entirely of blood or pus. The quantity of pus varies from six to ten ounces; occasionally it may amount to much more than this. The fluid which first appears accumulates about the heart, but with increasing quantity, that organ is lifted from its bed, the fluid forcing its way to the bottom of the sac. In proportion to the amount of fibrin present will the membrane be thickened and fibrinous masses float in the fluid. The membrane may even attain a thickness of a quarter of an inch or more, and present a shaggy appearance. With absorption of the more fluid portion of the exudation, adhesions usually take place, resulting in a greater or less degree of obliteration of the pericardial sac. The union between the two surfaces may be very firm. If the exudate is of a purulent nature, the membrane presents a rough, gray, creamy surface, which may also be eroded. The cardiac muscle in this case usually degenerates, and endocarditis is not an uncommon association. A purulent exudation rarely occurs in cases of the ordinary sero-fibrinous variety, which are usually due to rheumatism, but is more commonly found in the pericarditis of septicæmia, puerperal fever, tuberculosis, Bright's disease, etc. A purulent pericarditis is much less frequent than is purulent pleurisy. A purulent effusion may exceptionally become putrid with resulting formation of gas (pneumopericardium).

The influence of the inflammation upon the heart depends very much upon the intensity of the pathological process. In rapid cases, the heart muscle manifests but little granular degeneration; but in protracted cases, the myocardium becomes sodden or softened, and the heart itself dilated or atrophied. The influence of adhesions and disturbing bands of organized fibrin is favorable to hypertrophy of the heart, which is usually—at least in time—associated with dilatation and mural degeneration. Typical myocarditis may be associated, but the mural changes are, as a rule, essentially degenerative.

Symptoms.—As pericarditis seldom appears as an independent disease, or in one who is at the time of its incidence in good health, it is consequently an affection varying greatly in its clinical manifestations. When it sets in as a complication of other diseases, it often modifies the symptoms of the primary affection so little that it not infrequently fails of recognition. This is especially true of pericarditis as a complication of pleurisy, pneumonia, and other intra-thoracic disorders. Even physical examination is not always sufficient to determine its presence under such circumstances.

The onset of the disease is often most deceptive, especially in young subjects. This is frequently true of tuberculous cases. I have observed the same in the pericarditis of Bright's disease. The lack of prominence of symptoms distinctive of the affection in so many cases has led Balfour to state that "the symptoms of pericarditis are of comparatively little importance, because they are frequently entirely absent;" and Flint placed but little dependence upon individual signs, attaching every importance, however, to the symptomatic associations. In a large percentage of cases also the pericarditic symptoms are overshadowed by those of the primary disease.

The symptoms which suggest the possibility of pericarditis are fever, pain, palpitation, tenderness, dyspnœa, circulatory disturbances, etc.

The Fever is rarely high, remaining practically always below 102.5° F. It may be ushered in by a chill. When the primary disease has febrile manifestations the advent of pericarditis is sometimes manifested by an additional rise. There is so much truth in this statement that when, during the course of acute inflammatory rheumatism, there is an accession of fever without extension of the inflammation to additional joints, especial attention should be paid to the heart as the possible seat of new trouble.

Pain. Pain, though not a necessary symptom of pericarditis, is often present. Usually it is not of a severe character. Still it may be lancinating, tearing, constrictive, and the source of great suffering. In location, it is usually præcordial; but, in rare instances, it has been confined to the back. It sometimes simulates the pain of angina pectoris, spreading over the chest and extending down the left arm. In a given case it may

be constant, or it may be developed only on pressure or by deep inspiration. It is aggravated by whatever moves or jars the parts. It is especially marked to the left of the median line; but its principal focus may be below the nipple or over the lower third of the sternum, from thence radiating over the præcordium to the axilla, left arm, or even to below the diaphragm to the epigastric or left hypochondriac regions. Tenderness is sometimes observed when pains are absent. Pressure in the epigastrium beneath the cartilages of the ribs, upward towards the heart, sometimes develops pain. To be characteristic of pericarditis, this pain must be strictly localized to the præcordium. The pain of pericarditis is said to be due to the friction of the inflamed surfaces, and is directly proportionate to the intensity of the inflammation. It often, although not always, disappears when effusion takes place. Peripheral pains are a marked feature of some cases of pericarditis. They are variously distributed. The intense local pain has been ascribed to an acute neuritis of the cardiac plexus by Peter, a hypothesis which I was able to corroborate in one case of this disease seen in a little girl of eleven years of age.

Cardiac Palpitation and Changes in the Pulse. In the early stage of the disease the heart's action is accelerated and its rhythm disturbed. The patient himself is often conscious of a tumultuous action. Often, indeed, the changes in the pulse constitute the first evidences of pericarditis. As the disease advances, and the heart's action becomes increasingly obstructed by the accumulating effusion, irregularity of cardiac rhythm becomes pronounced, and intermittency may be added. The second sound of the heart may be reduplicated. During inspiration the pulse may be feebler or even cease (*pulsus paradoxicus*). The effect of the effusion on the pulse seems to depend in great measure on the rapidity of the process; in cases in which it increases slowly the heart has time to accommodate itself to the new condition of affairs. In rapid cases it is overwhelmed by the mechanical interference with its functions. The pulse may also be weakened by the secondary effect of the inflammation on the heart muscle. As shown by Walshe, the pulse in pericarditis is subject to remarkable variations in response to slight emotional excitement and effort. The pulse then, while possessing no diagnostic features, affords a valuable index of the condition of the heart.

Dyspnœa. This is a symptom, like most others of pericarditis, proportioned to the degree of oppression of the heart by the exudation. It may be of high grade and associated with inability to rest in the recumbent or, indeed, in any other position. The distressed appearance of the patient is not easily forgotten. The countenance is livid and anxiety is pronounced. The left lateral decubitus is generally preferred, as it hampers the right heart the least. With large exudations dyspnœa is increased by the pressure of the greatly distended sac upon the left lung, and in still others, by pressure on the trachea. Exceptionally, it may be

increased also by paralysis of the diaphragm owing to pressure of the distended pericardium on the phrenic nerves. The dyspnœa does not, however, always result from the mechanical effects of the exudate on the surrounding structures, but may ensue upon congestion of the lungs dependent upon the influence of the exudate on the right heart. Sometimes it depends upon involvement of the heart muscle in the inflammation, and in other cases upon a co-existent pleurisy. The rapid breathing so frequently observed in the early stage is usually the result of the cardiac excitement or of the nervousness of the patient.

The pressure of the exudate on the œsophagus may lead to difficulty in swallowing, and that on the recurrent laryngeal nerves, to weakness and even loss of voice.

The interference with the circulation in some cases becomes so great that dropsy and general cyanosis appear, the cervical veins become distended, the heart's action is weak, and slight exertion may cause sudden death.

Nervous Symptoms. These as described especially by Austin Flint, Sr., and Sibson, I have seen twice. Taciturnity, maniacal delirium with disposition to commit suicide, delusions, convulsions, and before death, coma, are the most prominent features in this connection. The symptoms sometimes resemble those of mania a potu most closely. A symptom described by Flint is the delusion that the patient has committed some crime. The especial feature of the nervous symptoms of pericarditis to be remembered is their resemblance to a variety of nervous affections, especially to meningitis, mania, dementia, epilepsy, chorea, etc. So prominent have these symptoms been in some instances, that they have entirely obscured the primary disease. Pathological conditions of the nervous system sufficient to account for these interesting groups of symptoms have not yet been discovered.

Clinical Course and Results.—Pericarditis usually terminates in recovery, especially if associated with rheumatism, pneumonia, pleurisy, and other affections which have a limited duration and which generally result favorably. Even under these circumstances, however, the recovery may be incomplete. Relapses are not unusual, or the acute form may merge into the chronic variety. When arising as a complication, pericarditis may be of a subacute or even of a chronic nature from the outset. The evidences of improvement are to be sought in a diminution of pain, dyspnœa, palpitation, etc. Very often, however, on account of the meagre symptomatology of some cases, evidences of convalescence are to be developed by physical examination only. The rapidity of the accumulation of fluid is subject to great variation, the acme being reached in hours or weeks, according to the case. Absorption is equally variable. Even a purulent exudate is on rare occasions absorbed. The chronic form may be followed by adherent pericardium, cardiac hyper-

trophy, dilatation or atrophy, and degenerative changes in the heart muscle itself.

Death occurring during the acute form may result from the intensity of the attack, which is common, for example, in the pyæmic cases, or from its association with severe inflammatory affections within the chest; or even from the oppression of the heart by the excessive exudation.

Death subsequent to chronic pericarditis may be from pulmonary œdema, as well as from causes similar to those acting in the acute form.

Most cases of rheumatic origin and of those complicating the infectious fevers recover, many completely so; but even in these varieties all expressions as to the future of the patients should be guarded, as also in those associated with chest inflammation. The septic form and that accompanying Bright's disease, are nearly always fatal. Purulent pericarditis is a most dangerous malady, but recoveries do ensue, especially under surgical treatment.

Physical Signs.—Inspection. If the parietes are still yielding, as in young subjects, there may be distinct præcordial bulging. The chest wall may be œdematous, and, rarely, bulging of the intercostal spaces may occur. The cervical veins are often distended, and the descending diaphragm may depress the left lobe of the liver. There is often diminished respiratory expansion of the left side owing to compression of the left lung by the pericardial exudate. When the effusion is large, there may be epigastric bulging.

Palpation. Early in the course of the disease, the apex beat is normal in position, but is apt to be excited and forcible. With advancing exudation, it is gradually weakened, but more diffused, and may even become imperceptible. It is more distinct with the patient in the upright position. Oppolzer taught that in pericarditis the apex beat altered with the position of the patient. Gerhardt and others proved by experiment that this is not characteristic of this affection, but that the heart's impulse varies in certain positions even in healthy individuals. The pericardial friction is often perceptible to the hand. With accumulating exudate, the apex beat is elevated and carried to the left.

Percussion. The special fact developed by percussion is an increase in the area of cardiac dulness. This is caused by the distended pericardial sac displacing the lungs laterally. As the fluid effusion first accumulates above the heart, this organ occupying the bottom of the pericardial sac, there must of necessity first appear an extension of dulness upward. This may extend to the second or even to the first interspace. Laterally it is detectable a finger's breadth to the right of the sternum, and a little more than double that distance upon the left. Later, with the distention of the lower portion, the transverse area of dulness is increased, until in large effusions it reaches the nipple line upon the right, and the axillary line upon the left. At this time, percussion will

mark out an obtuse angled triangle with its base upon the transverse nipple line, its apex about the first rib or intercostal space. That considerable pericardial exudate may be present and not be demonstrable by the aid of percussion has been observed, and is due to the covering of the sac by an emphysematous lung, the retention of the fluid posterior to the heart, or to the conduction of the tracheal or bronchial percussion note. Position alters the shape of the dull area somewhat, *e.g.*, when upright, the broadest line of dulness is upon the transverse nipple line. Extension of dulness to the left of the apex beat is quite certain evidence of pericardial accumulation. Compression of the left lung leads to altered percussion note especially conspicuous in the axillary line. Position may alter this sign. Vocal fremitus is present, and differentiates this condition from pleurisy with effusion. It is helpful from day to day to outline the area of dulness with an aniline pencil.

Auscultation. The early friction sound which is usually heard at the base or upon the left line of cardiac dulness disappears with the free accumulation of fluid, or adhesion of the roughened surfaces, but it may in some instances still be heard at the base or the apex, even with large effusions. It may be restored with absorption of the fluid. The heart sounds are progressively weakened, disappearing first at the apex and lastly at the aortic or pulmonary regions. The cardiac rhythm is altered. Coexistent endocarditis may lead to murmurs. Compression of the lower lobe of the left lung may lead to bronchial or bronchovesicular breathing.

Diagnosis—Very much of what has been stated under previous heads relates so intimately to the diagnosis of pericarditis that it is only necessary in this place to make a few supplementary remarks bearing on the subject. The importance of the physical signs can hardly be overestimated, as a diagnosis is impossible on the symptoms alone. Pericarditis may be mistaken for endocarditis or dilatation of the heart. It is also possible, according to Niemeyer, that thoracic aneurism, great distention of the right auricle, infiltration of the anterior edges of the lungs, and retraction of the lung exposing a larger portion of the pericardium than normal, may simulate pericarditis.

Pericarditis may be distinguished from *endocarditis* by the superficial character and the localization of the friction sound, and its increase or decrease by changing the position of the body, and by pressure. The maximum intensity is over the right ventricle, and especially at the point of union of the fourth rib and sternum. Endocardial murmurs are of different quality, are diffused to the left or the right of the cardiac region, or may be transmitted along the lines of the arterial trunks. Again, pericardial sounds do not bear the same synchronous relation to the heart sounds as do those of endocardial origin, which replace, precede, or follow the systole or diastole.

To distinguish between *pericardial effusion* with its signs of weak heart and the increased dull area of dilated heart, is generally considered to be at times difficult; we might truly say, occasionally impossible, for good observers have punctured the heart supposing they were tapping a distended pericardium. The history of the case indicating an acute onset, the friction sound which may still be present over the base of the heart, the feeble muffled heart sound which becomes more distinct as the ear passes to the base of the organ, the pyramidal dulness, and the absence of dropsy and venous stasis, are the most important differential features of pericardial effusion as related to cardiac dilatation.

Treatment.—In directing a plan of treatment for a given case of pericarditis, the nature of the primary disease must always be borne in mind. In all cases, however, there are certain general principles to be followed. The most important of these is absolute rest. Reference has already been made to the fact that the inflammation of the pericardium is modified by the movable organ contained within its sac. It is absolutely necessary to quiet the heart's action as much as possible, for which purpose the patient must forego every physical exertion, even the mildest. Emotional excitement of every kind must be avoided. The patient's clothing should be of flannel, and it may even be advisable to direct that he lie in bed between blankets. Hot poultices applied over the heart serve to mitigate the pain to a considerable degree, besides draining the deeper bloodvessels by dilating those superficially situated. In preparing the poultice the directions given by Brunton should be followed. If prepared according to ordinary methods, the poultice will be too hot when fresh; or, if of the proper temperature at the time of application, it will soon become cool and require removal. But, first apply a thick flannel over the heart, and over this again a very hot poultice. Now the great heat will not burn the skin, and at the same time the necessary degree of warmth can be maintained for a considerable time. Cold compresses, ice bags, and Leiter's tubes have been highly praised by some physicians, notably by Lees, Nothnagel and Fothergill, but do not seem to have gained the favor possessed by dry heat. Thomson remarks that he has never seen any advantage derived from cold applications in his hospital experience. Stimulants are admissible only on indications furnished by the pulse. If the heart's action is shown to be weak and failing, they must be given freely. At the same time the cause of the impending failure must be discovered. If, for example, it is learned that the heart's action is embarrassed by the great effusion, then the rational course is not stimulation, but the removal of the mechanical obstacle to good circulation, and that by paracentesis of the pericardium.

In our medicinal treatment we must not lose sight of the underlying affection. If the case is of rheumatic origin, the most energetic antirheumatic treatment must be continued. If of uræmic origin, every

means to eliminate urea must be adopted. Old school authorities have practically abandoned active medicinal treatment in this disease. Mercurials, which were at one time so popular, are now largely discredited. Fagge says, "the treatment of pericarditis according to modern practice is far from being active, and would have been regarded as very inadequate by the early auscultators." *Colchicine* has proven a valuable preventive of rheumatic pericarditis, not one case of pericarditis having occurred in over one hundred and fifty cases of rheumatic fever treated with this remedy by the writer and several friends. This is much superior to the best reported results from the use of salicylates. Laurie and Kidd have used *colchicum* empirically as a remedy for the disease itself when of rheumatic origin, following its exhibition, when the fever has disappeared, by arsenic, cantharis, apis or plumbum to hasten absorption of the effusion. There is much to say in favor of quite a number of our remedies. Of all which have been recommended, *spigelia* has given me the most favorable results. I hasten to give it as soon as the diagnosis is clear, if another medicine is not indicated. It is the remedy *par excellence* during the painful period, and until liquid effusion is pronounced. Fleischman, of Vienna, used no other remedy than this one. The pains are predominantly sticking in character, and are accompanied by great oppression and anxiety; palpitation is violent, and the pulse irregular. *Cannabis* was a favorite remedy with Hartmann, indicated by anxiety, palpitation and lancinating pains in the præcordial region. When the stage of effusion is well developed, *arsenicum* is most useful, and that irrespective of the character of the liquid, but especially when the effusion is of a serous character. It may relieve the anxiety and oppression before the exudate is removed, a fact mentioned and commented on by Hughes. Special symptoms calling for it are constrictive pain at the upper part of the sternum, violent and irregular palpitation, nocturnal anxiety, and a tendency to fainting. When the heart feebleness is not improved by arsenicum, *digitalis* should be given. *Mercurius corrosivus* and *cantharis* act more favorably if the inflammatory symptoms are more active or the exudate purulent. Hughes, Jahr, Baehr and others advocate the administration of *aconite* in the earliest stage, and recommend that it be succeeded by *bryonia* during the stage of effusion, especially if the latter be of a plastic character. The propriety of *aconite* as the remedy is strengthened if there be present a well-marked fever, anxiety and restlessness, accelerated pulse, præcordial pain and tendency to fainting. In protracted cases, Baehr strongly recommends *sulphur*. Hale claims good results from *asclepias tuberosa*. When the cardiac pains are sticking in character and continue until late in the course of the pericarditis, *kali carb.* is the most suitable remedy. Another one of the potassium salts is often useful in this disease—*i. e.*, the *iodide of potassium*. It may be administered in potency or in small

doses (fifteen grains daily) of the crude salt. The characteristic indication is a smothering feeling, even arousing the patient from sleep. It promotes the absorption of the effusion.

In cases with marked effusion, removal of the fluid becomes necessary to save life. Capillary drainage as recommended by Eklund may prove valuable. Inasmuch as good observers have several times punctured the heart by mistake it is always advisable to make an exploratory puncture with the hypodermic needle in the left fifth interspace before using the aspirator, it having been demonstrated that the needle wounds of the heart are by no means dangerous.

To perform paracentesis pericardii, the spot selected for puncture (the fourth or fifth left interspace near the margin of the sternum) should be carefully divided with a scalpel. When the pericardium comes into view, it is to be punctured with a fine trocar and canula.

Purulent pericarditis calls for prompt removal of the fluid, and even free incision.

PERICARDIAL ADHESIONS.

The occurrence of pericardial adhesions, leading to a partial or total obliteration of the pericardial sac, as well as to morbid changes in the heart itself, and surrounding structures, has been commented upon in the preceding section. Largely for the reason that this condition is found post-mortem without a history of preceding acute pericarditis, many observers have recognized an adhesive variety of the chronic form of pericarditis, a form which may in some cases progress to a complete obliteration of the sac without marked symptoms. The history of adhesive pericarditis, however, is not always so silent. The degree of adhesion may vary from a few fibrinous bands up to complete obliteration of the sac, the resulting membrane encasing the heart varying in thickness from that of a thin layer up to a quarter or half an inch. The consistence and degree of organization vary much. The deposit of calcareous matter in the new tissue may result in an almost complete investment of the organ by a hardened shell. Valvular lesions are often present, thus accounting for the frequent association of enlargement of the heart. The myocardium is often degenerated. Complete adhesion occurs with the greatest frequency in children.

The **Symptoms** of pericardial adhesions are in a great measure indefinite. Functional disturbance is common, but must be frequently referred to associated valvular lesions, a systolic apical murmur or degenerative changes in the heart muscle being occasionally associated. When the adhesion is general and the membrane enclosing the heart is thick and tough, the heart's power is influenced seriously, leading to hypertrophy with subsequent dilatation, dyspnœa, dropsy, cyanosis, and the pulse evidences of a feeble organ. The physical signs of most

importance are retraction of the chest over the apex region during the heart's systole. This sign seems to be the natural result of adhesions between the heart, pericardium and the parietes of the chest. The depression can be seen and felt, and is due to the pulling on the external tissues by the heart in systole, during which a shortening of the organ occurs. Strümpell states that this sign is only positively diagnostic when it involves the whole cardiac region, a systolic retraction at the apex occurring in other conditions. It is usually more pronounced during inspiration. The systolic retraction may be followed by a diastolic rebound, which when present, is the more characteristic sign. Friedreich's sign—collapse of the cervical veins during the heart's diastole—is still less diagnostic. It was evidently based on the observation of one case. The sign disappeared as the heart's action grew feebler.

Physical signs of hypertrophy and dilatation are developed in time, and it is to them that the accompanying symptoms are mainly due.

Prognosis.—This must depend upon the degree of alteration in the functions and structure of the heart.

No medicinal or surgical treatment can be directed to the removal of pericardial adhesions, the difficulty being mechanical and irremediable, but as compensation fails and other changes in the heart occur, treatment based on purely symptomatic indications is required. Such measures, however, are identical with those useful in other affections of the heart, associated with the same character of discomfort, and must not be regarded as directed against the adhesions *per se.*

HYDROPERICARDIUM.

Definition.—A non-inflammatory collection of fluid within the pericardium.

Under normal conditions a certain amount of fluid is always found in the pericardium, and this may be increased by several ounces shortly before death. Such an accumulation is not entitled to the name of hydropericardium. It is only when the effusion amounts to four or six ounces or more, that we are justified in giving it a special designation.

Etiology.—Hydropericardium is always a secondary affection, being practically a complicating factor of quite a variety of morbid conditions. It may develop in the course of the hydræmia of the feeble and cachectic, but is more frequently the result of causes developing a venous stasis in the pericardial membrane. It is often a part of a general dropsy arising from any cause, but is especially frequent in connection with dropsy due to pulmonary, cardiac, or renal disease. A pericardial effusion of local origin arises from obstruction of the veins of the heart, which may appear in association with valvular disease or various lung lesions, as bronchitis, phthisis, emphysema, etc. It has been known to occur as a sequel of scarlatina without the intervention of any general

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dropsy. It may occur secondarily to any condition which enlarges the pericardial space, *e. g.*, atrophy of the heart substance subsequent to hypertrophy, and adhesions between the pleura and pericardium followed by contraction, thus distending the sac.

Morbid Anatomy.—The pericardium presents no evidence of inflammation, in fact its appearances are normal with the exception of some slight opacity or thickening due to interstitial œdema. The effusion is generally of a light yellow color, containing but a slight amount of albumin, and being non-inflammatory in origin, is free from fibrin. If the capillary vessels are impaired by poor nutrition, they may rupture, thus causing the admixture of blood with the fluid. The quantity of fluid present ranges in quantity from a few ounces to several pints. It is very rarely, however, as great as in pericarditis with effusion. Owing to the pressure of the accumulation, the heart may atrophy, the adipose tissue about the organ disappear, and the connective tissues become œdematous. Large effusions compress the lungs and dilate the thorax.

Chylo-pericardium is a rare form in which the exudate is of milky appearance.

Symptoms.—Pericardial dropsy does not cause any symptoms other than those incident to interference with the heart's function by reason of the accumulated fluid. The dyspnœa and symptoms of enfeebled heart which are common, have usually antedated the effusion, and are simply aggravated by its advent. Dyspnœa is always a prominent symptom, the patient being obliged to sit erect in a forward position day and night. The pressure of the accumulation adds to the distress already present, increasing the general dropsy, the cyanosis, etc.

Diagnosis.—This must be based upon the physical signs in association with the history of the case. Search for the underlying causative condition must always be made. The physical signs are about the same as in pericarditis with liquid effusion, the friction sound which exists during the dry stage of the latter disease, of course being absent. Bulging of the chest wall is rare.

Prognosis.—The prognosis depends very largely upon the cause of the trouble, but under the best of circumstances is exceedingly grave.

Treatment.—This consists in paracentesis when the accumulation becomes of serious dimensions. Among remedies, *apocynum*, *arsenic*, *apis*, *digitalis*, *strophanthus*, and *lachesis*, give the best results. The general condition of the patient as a rule requires more attention than does the pericardial effusion.

HÆMO-PERICARDIUM.

Hæmo-pericardium is a rare condition which must not be confounded with a sanguineous effusion occurring in the course of tubercular, cancerous and cachectic pericarditis. It consists of hæmorrhage into the peri-

cardial sac. It may be due to any lesion of the heart or first portion of the aorta, culminating in rupture and escape of blood into the pericardium. Aneurism of the heart, coronary arteries, or of the first portion of the aorta, are the most frequently observed causes. It has also ensued from stabs and bullet wounds, and from the rupture of the bloodvessels of malignant growths in this situation. In a heart in my possession, taken from a physician under my treatment, there was a rupture of one of the coronary arteries and extravasation of blood into the myocardial tissues; several days later the rupture extended into the pericardial sac, resulting in sudden death. The rupture of the artery was attended by pain at the heart, faintness, palpitation, cool perspiration, etc., but was followed by considerable improvement up to the time of the second attack. The final symptoms in these cases are due to the compression of the heart by the effused blood, and are modified greatly by the rapidity with which it escapes. Death may occur within a few minutes, or the fatal ending may be postponed for days. Should the oozing be slow considerable distention of the sac may result. If life is sufficiently prolonged, a pericarditis may supervene.

The **Diagnosis** can rarely be made with any certainty, but if in a person known to have aortic aneurism or degenerative disease of the heart walls, sudden pain, dyspnœa, etc., are developed, and physical examination reveals an increasing area of dulness, hæmo-pericardium may be suspected.

The **Treatment** amounts to but little, owing to the insurmountable mechanical problems involved. Absolute rest is of course necessary. Aspiration has been performed successfully in some cases, but affords little hope. Remedies directed to the underlying degenerative conditions are admissible.

PNEUMO-PERICARDIUM.

Pneumo-pericardium is a rare affection, consisting of the presence of air or gas in the pericardial sac. Shortly after the appearance of the gas in this situation pericarditis nearly always ensues, hence effusion of fluid is sooner or later present, and this may be either serous or purulent, according to circumstances. While gas may be evolved from purulent matter within the pericardium, it usually enters that cavity from adjacent organs containing air, as the œsophagus, stomach and lungs. The communication may be established by traumatism, as stab-wounds, or the perforation of the œsophagus by a foreign body. In a case of my own, the pneumo-pericardium resulted from the perforation by a tin tobacco-tag, which lodged in the œsophagus and ulcerated through the parts. Malignant disease may also lead to the opening of the pericardium by ulceration. Abscess of the liver or mediastinum, a phthisical cavity of the lung, or even the aspiration needle may be a cause of this condition.

Symptoms.—The distinctive features of pneumo-pericardium are the physical signs, which are characteristic. The præcordium is observed to be distended, and percussion shows areas of dulness and tympany, which change relationship as alterations in the position of the body are made. Auscultation, moreover, reveals a peculiar splashing metallic sound, caused by the movements of the heart in the fluid and gaseous contents of the pericardial sac, sounds which may, indeed, be heard at quite a distance from the patient. The heart's impulse is weak, but is more apparent if the patient is made to sit upright and lean forward. In this position the fluid will gravitate to the front, and some of the area which was originally tympanitic while lying will now become dull. Pneumo-pericardium is generally rapidly fatal. The danger is from immediate collapse, or later, from pericarditis. The most hopeful cases are those arising from traumatism.

The **Treatment** is much the same as that recommended for pericarditis. In external traumatism the sac should be opened and the wound treated upon surgical principles.

Diseases of the Endocardium.

ENDOCARDITIS.

Definition.—Inflammation of the lining membrane of the heart.

Varieties.—Endocarditis may be either acute or chronic. The former is usually described under two heads: (1) Simple acute endocarditis, also called simple exudative endocarditis; and (2) malignant or acute septic or ulcerative endocarditis.

Chronic endocarditis is known as valvular disease of the heart, interstitial endocarditis, valvulitis, etc.

SIMPLE ACUTE ENDOCARDITIS.

Etiology.—Simple acute endocarditis is probably invariably a secondary affection. *So-called* idiopathic cases are not of extreme rarity however. Many cases that can be traced to no definite determining disease, are doubtless of rheumatic origin; the vague joint pains preceding and accompanying the affection being considered of little moment by the patient, and not sufficiently marked to give rise to typical joint manifestations recognizable by the physician. Some authors, *e. g.*, Germain See, go so far as to attribute all cases to the action of micro-organisms, but the facts in our possession do not warrant so sweeping a generalization. In the first place, cases are frequently observed in which no micro-organisms of any kind are discoverable. In others, the specific organism of the disease to which the endocarditis is secondary, as the pneumococcus or the typhoid bacillus, have not been found. Some cases have been associated with the tubercle bacillus, but this is regarded by many authorities as a mere coincidence, although a tubercular endocarditis is admitted. Nevertheless, it is interesting to observe that most cases are associated with diseases of bacterial origin, or those in which marked alterations in the blood are prominent features. Most important of these primary affections is rheumatic fever. Fothergill has furthermore remarked that an acid condition is frequently present in endocarditis, this being the case also in rheumatism and gout, and, as Virchow has shown, also in pyæmia. The frequency with which endocarditis is preceded by acute rheumatism is such that thorough clinicians keep a careful watch over the condition of the heart in every case of the latter disease. From 60 to 85 per cent. of all cases of endocarditis have been estimated to have resulted from acute inflammatory rheumatism, and,

according to the statistics of Bellevue Hospital, New York, fully one-third of the cases of inflammatory rheumatism are complicated by endocarditis. By some authorities an even larger proportion is conceded, namely, one-half. The danger of endocarditis seems to be especially great when a large number of joints are involved, and in the first or second week of the course of inflammatory rheumatism, although it may exist before the joint changes are fully manifest, and in not a few instances endocarditis may be the chief manifestation of a rheumatic attack, only a single or a few joints showing involvement. Therefore the occurrence of rheumatic endocarditis is not limited to the typical acute rheumatism above referred to. Charcot and others are firmly convinced that it may follow chronic rheumatism, and it is said to occur occasionally even in association with tonsillitis, which is often of rheumatic origin. Its association with chorea, which also bears a relationship to rheumatism, is well known. Next in order of importance as a cause of endocarditis is Bright's disease, especially that variety known as parenchymatous nephritis. Less important causes are measles, scarlet fever, variola, pneumonia, diphtheria, typhoid fever, varicella and gonorrhœal rheumatism, and it may occur occasionally in secondary syphilis. Wunderlich places measles as next to rheumatism the most frequent cause of endocarditis. Osler states the absence of endocarditis in 65 cases of typhoid fever on which he held autopsies, and its presence in 12 out of 216 cases of phthisis. Others than Osler have described a tubercular endocarditis. Hanot, for example, describes three varieties which he names (1) the caseous, (2) the granular, and (3) the ulcerative, the second being most frequently observed. He does not attribute the endocardial inflammation to the tubercle bacillus, but rather to the toxins produced by that micro-organism.

Various affections characterized by debility, anæmia, etc., as malignant disease, diabetes, gout, etc., appear to favor it. Syphilis, peliosis rheumatica, and the hæmorrhagic dyscrasia are believed to cause it. Pregnancy and the puerperal state are held responsible for some recrudescences. Local injuries to the valves or the chordæ tendineæ, or extension of the inflammation from the peri- or myocardium, are rare excitants of endocarditis.

Men are oftener attacked than women. Especially does this remark apply to those debilitated by chronic alcoholism. In respect to rheumatism—the most frequent cause of endocarditis—it can be said that there is no necessary relation between the *intensity* of the articular inflammation and the tendency to heart inflammation.

Pathology and Morbid Anatomy.—The general features of especial interest are (1) the partial or patchy character of the lesion, the valves and the adjacent parts being the usual points of attack. (2) The proliferating tendency of the inflammatory action, with secondary

sclerotic changes, the latter being the especial cause of the subsequent heart disability. (3) The almost constant involvement of the left heart. (4) The involvement of the right heart in fœtal endocarditis. (5) The frequency of embolism.

The restriction of the inflammation to the valves and their vicinity is a marked feature of the disease, and especially characteristic is the presence of vegetations upon the valves, these varying in size from a minute point up to (in cases which have existed for a long time) a cauliflower-like growth of considerable bulk. These excrescences may be mere prominences, or again they may be attached by more or less slight pedicles, so slight, indeed, in some cases, that their separation from the valves becomes an easy accident, and they are washed into the blood current, producing embolism of distant vessels. These bead-like growths are generally situated two or more millimetres from the margin of the valves; in other words, along the line of maximum contact of these structures. The mitral valves are most frequently attacked, the granulations developing upon the auricular surface, theopposite being true in aortic valvulitis.

The endocardium, being largely composed of connective tissue which lines the heart and forms the valves, is covered with endothelial cells in the valvular region, and this partially explains the usual location of the inflammation and the character of the process. The cellular character of the inflammatory change, the ordinary products of inflammation being absent, is especially due to the insufficient supply of blood-vessels. The connective tissue cells are especially concerned. The new growth has a tendency to degenerate and undergo calcification. The fibrin which is found covering the valves is whipped out of the blood current. In mild cases the valves may be simply swollen, their surfaces remaining smooth. The subsequent changes in the inflamed valves and orifices is one of contraction, with shortening, deformity, and consequent constriction of the ostia or imperfect closure of the valves. Neighboring leaflets may be bound together or the valves may be firmly attached to the walls of the heart or to the aorta. These changes will be all more fully described in the consideration of the chronic form of endocarditis.

Symptomatology.—There are few disease in which the symptoms are more uncertain than they are in endocarditis. Loomis says most positively that more than in any other disease the symptoms have no regular order of development, and many of those that do occur seem to result from the involvement of the walls of the heart in the inflammation.

Symptoms, the occurrence of which primarily, or during the course of some affection known to be an excitant of endocardial inflammation, suggest the development of endocarditis, are: pain, palpitation, increased fever, dyspnœa, cardiac enfeeblement and arrhythmia.

Pain is not apt to be a prominent symptom. Even when present it

is not severe, but usually dull in character. There is much reason to suspect that its presence is significant of a complicating pericarditis or pleurisy. Sometimes pain is referred to the epigastrium, a feature especially characteristic of the endocarditis of children. Præcordial distress is often complained of, the patient describing it as a sense of weight over, or a tight band about the heart.

The patient usually complains of excited and abnormally strong action of the heart, this being especially perceptible to the sufferer. Later, the pulse becomes feeble and even irregular. It is usually frequent from the very beginning of the disease. A disparity between the force of the pulse and the heart's activity is often perceptible, for, with extended involvement of the heart, irritability increases and the propulsive power of the organ diminishes.

The temperature changes are no more characteristic than are the other symptoms. Sometimes there is a slight fever, or when the endocarditis is secondary to another disease, an aggravation of the pre-existing febrile symptoms. With the advent of the endocarditis the temperature may rise abruptly, and be associated with sweating, sudamina, and other concomitants of high temperature. It seldom rises above 102° or 103° F., although cases in which it reached 105° F., without any articular inflammation, have been reported. These high temperatures of endocarditis are observed with especial frequency in children of a rheumatic diathesis.

Dyspnœa is sometimes present, and may be of variable intensity, paroxysmal, or constant. In mild cases it is manifested by slight acceleration of respiration, or labored breathing. In the severe it is accompanied by all the evidences of impaired circulation.

Physical Signs.—Inspection. The patient lies on his back or inclines to the left side. The area of cardiac impulse is observed to extend over a greater space than normal. In advanced cases the heart may be so weak that its pulsations are imperceptible to the eye. Evidences of venous stasis are found in distention of the vessels of the neck. General cyanosis is occasionally observed.

Palpation discovers very exceptionally an endocardial thrill, and the changes in the cardiac impulse discovered by inspection, to which reference has just been made. The heart's action is early increased in force and frequency. When acute dilatation (a not infrequent occurrence) takes place, the cardiac impulse is weakened.

Percussion shows the normal area of cardiac dulness unaffected. An exception is found in those cases in which endocarditis is associated with acute dilatation.

Auscultation reveals a bellows murmur—a soft, blowing, systolic sound, heard best at the orifice or valve affected. Typical transmissions are seldom, if ever, heard in the first stage of endocarditis. The reason

for this is obvious, the inflammatory changes are seldom sufficiently organized and condensed to permit of transmission. The diagnostic murmur is one that grows in intensity at every successive examination. It is not until late in the disease that the murmur is transmitted. Preceding the murmur, as already stated, the first sound of the heart is prolonged or harsh. This murmur is due either to mitral insufficiency or roughening of the ventricular endocardium. When due to the former cause there is associated an accentuation of the second sound at the pulmonary orifice. Murmurs may be related to the other valves, but with far less frequency than the mitral. Diastolic murmurs sometimes occur, but are exceptional, their presence being strongly suggestive that the trouble is not of recent origin. In children a double murmur is often heard at the mitral orifice.

Of late, even the physical signs which were at one time looked upon as diagnostic, have been regarded as not positively reliable. The development of a murmur within one of the cardiac areas, even when associated with fever and other symptoms of an acute affection, is not evidence sufficient to justify a diagnosis of acute endocarditis. The careful study which has been recently devoted to acute endocardial murmurs, has led to a very different interpretation of their significance in many cases; *e. g.*, while a systolic apical murmur is indicative of mitral regurgitation, such regurgitation may not be due to endocarditis. A sign of beginning endocarditis is a prolongation of the first sound of the heart. This has been asserted by Sir William Gull and Dr. Sutton, and was confirmed by Sibson in eighteen out of twenty-two cases of "threatened" rheumatic endocarditis. Sansom thinks this phenemenon is due to swelling of the mitral curtains with a resulting elimination in some degrees of the valvular element of this sound. Such a prolongation may—and of course often does,—merge, with the progress of the disease, into a well-defined murmur. We must inquire then what other diseases than endocarditis may cause such regurgitation and consequent murmur. There is the best evidence that degenerative changes in the fibrillæ of the heart walls or of the papillary muscles may lead to enfeeblement of the ventricles and imperfect closure of the valves. Further, it has been determined, chiefly through the investigations of Ludwig and Hesse, that there are sphincter-like circular fibres at the auriculo-ventricular orifices, which have a modifying influence upon the size of the opening, their action during the ventricular systole being such as to favor the perfect closure of the valves, and it is easy to believe that by failure to act, they may so enlarge it as to prevent perfect valvular coaptation. The rapidity with which degenerative changes may occur is illustrated by the development of fatty changes in animals which have been bled to death. It is possible that in rheumatism and certain of the acute infectious diseases, there is a special tendency to these changes as well as to endocarditis.

Diagnosis.—The diagnosis of endocarditis depends upon the discovery of a valvular murmur associated with the symptoms suggestive of that disease. In some cases a positive conclusion is impossible because of the probability of the signs being dependent upon old lesions. The association of some degree of hypertrophy with the murmur indicates that the murmur is dependent, in part at least, upon pre-existing valvular disease. The murmur of endocarditis is generally systolic and mitral. Diastolic and aortic murmurs are generally dependent upon old valvular troubles. The crucial sign from which there is no appeal is the existence of a murmur which by repeated physical examinations is shown to have developed during the course of a disease known to have endocarditis as one of its sequelæ.

From *pericarditis* endocarditis is differentiated by the limitation of the murmur to the præcordial region in the former affection. The murmur, moreover, is heard nearer the ear, and is intensified by having the patient bend forward, or by increasing the pressure of the stethoscope, or examining ear against the chest. In endocarditis the murmur has points of special intensity varying according to the valve affected.

Aortitis, though a rare disease, may be confounded with endocarditis. Indeed the symptoms of the two diseases are often identical. Aortitis has, however, a more rapid pulse, and pain is a prominent feature. This pain courses along the spine as well as being manifested in the præcordial region, and is aggravated by any movement of the patient.

Functional cardiac disturbances, occurring during the course of acute febrile disorders, sometimes give rise to diagnostic error. In them, however, murmurs, if present, are most marked at the base of the heart, while in endocarditis they are best heard at the apex, if the lesion is mitral. In the former also there are no evidences of obstructed circulation.

Prognosis.—The prognosis of endocarditis as regards life is, as a rule, favorable. It is different on the other hand as to the future integrity of the valves or orifices affected, permanent lesions developing in the majority of the cases. Some cases that begin as simple exudative endocarditis subsequently become of the malignant variety. The fatal issue in endocarditis is generally brought about by embolism of different viscera as manifested by sudden splenic enlargement, albuminuria, hemiplegia, etc. Endocarditis in children is less apt to be followed by permanent heart lesions than in the case of the disease in adults. The duration of endocarditis is quite variable. Many cases recover in two or three weeks; others, less fortunate, linger along for several months.

Treatment.—The patient should be made to lie between blankets. Every means of resting the heart should be persistently employed. When it is possible, all conveniences which reduce exertion and exposure to the minimum should be enjoined. Even long after the patient has apparently recovered from his acute illness, protection of the chest

against changes of temperature should be secured by applications of a light layer of cotton-wool or flannel. The intimate relationship existing between the vaso-motor nerves of the interior of the chest and the adjacent surfaces explains the necessity for this measure. The diet should be simple and spare, but nutritious. As a rule it should be limited to nitrogenous matter. An excess of fluid should be avoided in order to lessen intracardiac pressure. Excellent results may sometimes be obtained from the warm bath at a temperature ranging from 90° to 100° F., repeated from one to three times in the twenty-four hours. The sedative influence of this measure upon the heart and general nervous system is most excellent.

Preventive treatment is always of importance. This should be limited to the employment of measures which combat the primary disease in the course of which endocarditis is most likely to occur. The early and efficient treatment of acute inflammatory rheumatism is thus seen to be of the greatest importance. The great value of *colchicine* in this affection, and its influence in the prevention of cardiac inflammation, will be referred to in the chapter treating of rheumatic fever.

When pain is severe, hot applications to the præcordial region are important. Pepper and others speak highly of the use of cold for this purpose, advising the employment of the ice-bag or Leiter's tubes.

As to medicines, it may be said that the value of *aconite* in the early stages of sthenic cases is conceded by most observers of both schools of practice. I give it in the lower dilutions or in drop doses of the tincture. The higher the temperature, the more strongly is it indicated. Other symptoms suggesting its employment are anxiety, great swelling of the joints with acute pain, restlessness, and pulmonary congestion. In some very rapid cases with a high grade of sthenic symptoms, *veratrum viride* is preferred by Hale and other practitioners. The action of the heart is far more violent than under aconite. Congestion of the lungs calls for its exhibition even more urgently than it does for that remedy. More than aconite, it is useful in cases of idiopathic endocarditis. Hale does not look upon a quick pulse as a necessary indication for this remedy, having seen good results from it in cases in which the reverse condition obtained. If reasons for a change from either of these medicines appear, it is best to turn to the well-tried and efficient *spigelia*, if it be not contra-indicated. Ten drops of the tincture should be mixed with four ounces of water, of which solution teaspoonful doses should be given hourly. Both *aconite* and *spigelia* are peculiarly valuable in cases of rheumatic origin. Fleischmann, of Vienna, was accustomed to giving spigelia indiscriminately in all cases of acute cardiac inflammations, and with most excellent results. If spigelia is insufficient, *iodine* and *spongia* should be considered. Kafka recommends the former after spigelia. The dyspnœa pain and the oppression in the cardiac region, and the

inability to lie with the head low, suggest spongia. In this latter condition, *cactus* 1x may also help. The sensation of constriction about the heart, so generally looked upon as characteristic of this medicine, is occasionally present. Intense occipital pain is also regarded as a strong indication for cactus.

Other possible remedies are *bryonia, belladonna, cimicifuga, convallaria* and *digitalis. Bryonia* is often indicated and is of clinical value in rheumatic cases. Its use has been suggested purely upon pathological indications. *Belladonna* is often indicated, especially in the rheumatic endocarditis of children.

In serious cases with dilatation and threatening failure of the circulation, *alcoholic stimulants must* be used in moderate quantities, along with such remedies as *glonoin, digitalis, caffein, convallaria, strophanthus,* etc.

Colchicum has been used by Petroz and Jousset for the endocarditis following acute rheumatism when aconite has proven inefficient. The heart symptoms of this drug are strong action and a tearing pain in the cardiac region. The pulse is small, accelerated, filiform and trembling. Jousset prescribes ten drops of the mother tincture in seven fluid ounces of water, of which solution he orders a teaspoonful every two hours. Jousset attaches considerable importance to the value of *arsenic* in the disease under consideration. It is to be given after the periods in which aconite and cactus are useful, and when dyspnœa, weak and irregular pulse, with considerable diminution of the arterial tension indicate a state of gravity. Other symptoms indicating it are anxiety with mental agitation, nocturnal aggravation, anasarca, congestion of the liver and albuminuria.

Long rest in bed, after the subsidence of the acute symptoms, together with the administration of medicines having an absorbent and resolvent action, such as *sulphur, graphites, aurum, iodine, spongia* and the *iodide of potassium,* tend to lessen the extent of the inevitable damage to the orifices and valves.

ACUTE INFECTIOUS ENDOCARDITIS.

Synonyms.—Acute septic endocarditis; malignant endocarditis; ulcerative endocarditis; diphtheritic endocarditis; mycotic endocarditis; arterial pyæmia.

Definition.—A comparatively rare but intense form of endocardial inflammation, due, at least in most instances, to micro-organisms, the resulting exudate tending to disorganization rather than to organization.

History.—Malignant endocarditis first received mention in medical literature in 1851, by Wilkes, who explained many of the phenomena of that disease. In the same year Ormered considered the subject in his Gulstonian lectures. Since that time the literature of the subject has

been enriched by the investigations of Wilkes, Ogle, Moxon, Bristowe, Charcot, Vulpian and Virchow. The ablest exposition of the disease in recent years is to be found in Osler's Gulstonian lectures of 1885.

Etiology.—There is every reason to believe that malignant endocarditis results from some infection, micro-organisms being found in the vast majority of examples of the disease. Virchow, who was the first to advocate this view, believed that in many instances the specific infection entered the body by way of wounds. Even small wounds and inflammatory lesions are sufficient in many instances, for infection has taken place through boils, superficial erosions, suppurating corns, etc. The possibility of the disease arising in healthy valves by infection has been seriously questioned, although Ribbert succeeded in producing malignant endocarditis by inoculation without previously making the valves susceptible by traumatism. The occurrence of infection of apparently healthy valves in actual practice receives a very plausible explanation in the injury to these structures incident to high arterial tension and cardiac hypertrophy. The ease with which an acute or chronic valvulitis may provide an avenue for infection, by inducing local cellular depression, is of course universally admitted.

Osler's series of 209 cases gave a history of preceding or existing disease to which the endocarditis was directly traceable in 127, the primary diseases being rheumatism, pneumonia, the specific infectious fevers, septicæmia, erysipelas, diphtheria, puerperal infection, dysentery and intermittent fever. In many of the rheumatic cases sclerotic valves are found. Pneumonia, far more frequently than any other disease, seems to give rise to malignant endocarditis, having been the cause in 54 out of Osler's 209 cases. Instances have been observed as complications of periostitis, osteo-myelitis, pyelo-nephritis and other suppurative diseases.

Owing to the frequency with which malignant endocarditis occurs in association with puerperal septic processes, it is oftener observed in women than in men. The predisposing age is that of middle life, children and people past fifty years of age rarely being attacked. The fact that it is almost always a secondary affection has already been suggested. Still cases do occur, apparently idiopathically, in debilitated subjects, especially in those habituated to alcoholic excesses and the subjects of chronic valvular disease with failing compensation.

Pathology and Morbid Anatomy.—As in the simple form, it is the left heart and the valvular regions which are most frequently attacked. This is probably because the left side the more frequently contains lesions which favor the localization and multiplication of bacteria. The lesions are especially apt to affect the ventricular surface of the aortic and the auricular face of the mitral valves (*i. e.*, the surfaces subjected to the greatest friction), and consist of suppuration, ulcerations and vegetations,

singly or in combination. Ulceration is frequently observed, this fact giving the disease one of the names by which it is commonly known. It may be either superficial or deep. In the former case it involves the endocardium only; in the latter it extends deeply into the heart substance, sometimes perforating the walls or the septum. Vegetations, when present, are of variable size. They consist of soft and friable masses, of greenish-gray or grayish-white color, sometimes assuming a stalactite appearance, in others resembling immense cauliflower excrescences, very readily detached from the endocardial surface to which they are adherent. Sometimes small abscesses form, especially at the bases of the vegetations. The destructive changes produced by malignant endocarditis are consistent with its suggested microbic origin. The organisms present consist of both rod and round forms, staphylococci and streptococci, however, being most frequently observed. When the disease occurs as a complication of pneumonia it appears to be due to the pneumococcus. Eberth has demonstrated the highly infectious nature of the products of the inflammation by inoculation of the cornea of rabbits, the results being inflammation and necrosis.

The vegetations above mentioned may be readily detached, and lodging in distant organs, as the spleen, the kidneys, the brain, etc., inflammation and extensive destruction of tissue in these parts results. The serous cavities, pericardium, pleura, peritoneum, joints and the meninges, may be attacked with suppurative inflammation, and bacteria demonstrated in the purulent exudate.

Symptomatology.—The symptomatology of acute ulcerative endocarditis differs from that of the simple variety for several reasons. These include (1) greater intensity of the endocardial inflammatory process, (2) constitutional infection, and (3) embolic complications. The latter, on account of the involvement of certain organs and the secondary changes taking place in surrounding structures, gives rise to varying clinical pictures. It may be said that all of the symptoms of the simple variety are present, but are subject to important modifications and additions. As in simple endocarditis the symptoms are by no means distinctive. Able clinicians and diagnosticians have erred. Indeed, the majority of cases of ulcerative endocarditis have been recognized only at the autopsy. Aside from the lack of distinctive clinical phenomena, malignant endocarditis is so often an associated pathological state, or arises in the midst of other serious maladies as a secondary disease, that the diagnosis is rendered still more difficult. A prominent differential point is the relatively greater constitutional and fewer local symptoms than in the simple form. The general symptoms of themselves are always sufficient to indicate the presence of a serious malady, even if there is nothing to direct attention to the heart as their cause. This is not true of simple endocarditis.

Several types of malignant endocarditis have been recognized, viz., the typhoid, the pyæmic, the cardiac, and the cerebral. In the *typhoid form*, the one most commonly observed, the symptoms and conditions ushering in the attack simulate those of typhoid fever, but present important distinctions in the mode of onset. Whether coming on as a primary disease or in the midst of some fever, its advent is marked by a rigor or series of chills. Then follows a fever with irregular temperature curve, early and rapidly progressive prostration, nervous symptoms, such as delirium, stupor and coma, sweatings, looseness of the bowels, distended abdomen, swelling of the salivary glands and eruptions of varied character. A cardiac murmur may be present, or on the other hand, all the physical signs of endocarditis may be undiscoverable.

Another group of cases is represented by the prominence of the septic element. These are called the *pyæmic cases*. They are generally associated with primary affections from which it is possible for infection to occur, these being puerperal lesions, wounds, and a variety of inflammations. The symptoms are those common to septic poisoning, viz., chills, fever and sweats. These may recur in such a way as to simulate very closely the symptoms of malarial fever of various types; indeed, there may be no suspicion that the disease is not malarial in nature until the administration of quinine giving negative therapeutic results, indicates otherwise. The diagnostic difficulties are often increased by the presence of a history of preceding malarial attacks. Rheumatism and old organic heart diseases are less frequent antecedents than in the typhoid variety. General failure is rapid and great. The rapid progress of anæmia is a prominent feature. There may be a well-developed murmur as in the typhoid form, or all physical evidences of valvular lesions may be absent. The right heart is occasionally attacked, and then a murmur will be heard within the pulmonary area. The temperature may be very high during the rigors. The pulse ranges from 100 to 150 per minute. During the apyrexia it may be normal or subnormal in frequency. Dyspnœa, palpitation, and cyanosis may be present, and are usually due to myocarditis.

In the *cardiac group* there is every evidence of a fresh endocarditis engrafted on old endocardial changes. Sclerotic lesions in the valves have probably existed for a long time, and failing compensation is about to begin. The patient's general health is poor. The fever is irregular with evening exacerbations. The symptoms of embolism of different organs are manifested. Sometimes compensation is perfect up to the time of advent of the fresh attack, when the destructive changes prove all sufficient to produce serious cardiac disturbance, and direct attention to the heart as the *fons et origo mali*.

The *cerebral cases* include a most interesting clinical class. Very often the disturbances of brain function are so profound that it is diffi-

cult to believe that that organ is not solely at fault. The symptoms simulate very closely those of meningitis or cerebro-spinal fever.

In all varieties, the spleen may be swollen, the kidneys involved, as shown by albuminuria and hæmaturia, and embolism of various organs supervenes. Infarctions of the brain, spleen, liver, joints and lungs are most frequent. When in these embolic cases the symptoms do not direct attention to the heart and thereby reveal the true nature of the disease, there is every fear that the localized symptoms due to embolism may be mistaken for primary affections of the several organs, but notably nephritis, cerebro-spinal fever, pulmonary lesions, acute yellow atrophy of the liver, etc.

Remarking generally on the peculiarities of certain individual symptoms, the temperature is noteworthy because of its irregularity. Periods of low may alternate with high pyrexia. Remissions and intermissions occur in the same case without respect to any definite type whatever. Then again, all amelioration of fever phenomena may disappear and the temperature remain at one point for weeks at a time.

Rashes not infrequently accompany malignant endocarditis. For the most part they assume a hæmorrhagic type. They may even seem to confirm an erroneous diagnosis of cerebro-spinal or typhoid fever, or, as has actually happened, surprising to relate, hæmorrhagic variola.

Diagnosis.—The difficulties attendant upon the recognition of malignant endocarditis have been mentioned already, and means indicated by which it may be differentiated from the simple variety. From *typhoid fever* it is differentiated by the mode of onset, which is generally rapid and marked by chill or high fever. Constitutional symptoms occur earlier and are more severe in malignant endocarditis, and cardiac pain and oppression sometimes direct early attention to the heart as the seat of the disease. In the fully developed disease the fever is characterized by its irregularity, a point sufficiently distinctive to eliminate typhoid fever from consideration. Typhoid fever lacks cardiac pain, petechiæ, optic neuritis, retinal hæmorrhages, and early dyspnœa.

When, as has occurred, the clinical phenomena are identical with certain infectious processes, as pyæmia, variola, typhus, or cerebro-spinal fever, a diagnosis is impossible until the disease has continued over such a period of time as to make it impossible for the case in hand to be an example of any of the above mentioned diseases.

There are practically no means of differentiating malignant endocarditis from *pyæmia,* for, as Osler remarks, the latter is an "arterial pyæmia."

From *malaria* a differentiation may be easily made by means of a microscopical examination of the blood.

Much dependence must be placed upon the presence or absence of a possible source of infection, and by the extent and course of the embolic

processes. Unlike the infarctions in the simple form, they are here numerous and lead to rapid inflammatory and suppurative changes. Further, an asthenic or typhoid character of the symptoms from an early period of the disease, early loss of "pluck," and early dicrotism of the pulse, are all common features of infectious endocarditis.

Prognosis.—This is very unfavorable as regards life, no satisfactory evidence that any case has recovered having been offered. The general course and duration of malignant endocarditis vary greatly, being dependent, in great measure, on the nature of the primary affection. In most cases life is not prolonged beyond three or four weeks. Instances of a fatal issue within from two to five days, as well as a protraction to months, and even to more than a year, have been reported. A few cases reported during the past few years lead us to think that possibly the commonly accepted opinion as to the incurability of this affection may not be altogether correct. The reported examples do not seem to have been of the typically acute character, but rather protracted cases, or the recurring instances attendant upon chronic valvular disease. In any event the diagnostic uncertainties are such as to call for considerable conservatism in expressing the possibility of a favorable result.

Treatment.—As this disease, in its typical form, seems to be so invariably fatal, the treatment must be confessed as unsatisfactory. The general management of cases should be conducted on the same principles as in the simple form. The pyæmic origin of the disease will suggest many elements in the treatment. Remedies of an asthenic character must be selected, and include *lachesis, crotalus, arsenicum*, and probably others.

Jousset urges the employment of *aconite* and *sulphate of quinine*, saying that "this combination fits the purulent diathesis. Aconite corresponds to the elevated febrile movement with anxiety and great agitation; the sulphate of quinine to the intermittence with the malignant symptoms and the perniciousness of the disease. Among the heart symptoms produced by toxic doses of quinine there is a very short period at the first when the pulse is accelerated with increased heat; there is also weakness and slowness of the pulse with lowering of temperature. In a more advanced state there is a very feeble and irregular pulse with an associated lipothymic state, with considerable chilliness, cold sweat, lividity of the face and extremities, absolute loss of muscular power and, finally, complete collapse, absence of the pulse, coldness and syncope. This complex of symptoms reminds one of digitalis, and confirms the indication of quinine in malignant endocarditis."

Jousset prescribes aconite so that from twenty to forty drops of the tincture are given in the course of twenty-four hours. The sulphate of quinine he advises during the period of febrile decline, giving three doses of from one to one and a-half grains each, an hour apart.

Regarding the snake poisons, the symptoms of *lachesis*, owing to the profound effect of the remedy on the heart and nervous system, make its use very strongly indicated in ulcerative endocarditis. The mental condition is dulled, the patient is irritable and restless, convulsions of varied types may be present, dyspnœa is constant, the sense of suffocation is marked, the pulse is rapid and feeble, and even small and intermittent, and the disorganization of the blood may be so great as to cause hæmorrhages from different portions of the body. *Crotalus* is likewise often indicated, the evidence of blood decomposition being more strongly marked than under lachesis, as shown by the hæmorrhages, ecchymoses, and feeble cardiac action. Lilienthal does not favor the use of *naja* in this disease, as it lacks the symptoms of blood sepsis. *Secale*, he suggests, because of a symptomatic resemblance it bears to some cases; *i. e.*, emaciation and debility, emboli, cold extremities and collapse, vomiting of blood with collapse, anguish and dyspnœa, internal heat, pulse small, irregular and intermittent.

Valvular Diseases of the Heart.

MITRAL INSUFFICIENCY.

Of all lesions of the cardiac valves, mitral insufficiency is decidedly the most frequently encountered. Occurring as an uncomplicated condition, it represents about one-third of all cases of valvular disease, while an equally large percentage occurs in association with lesions of other valves. The pathological changes which most frequently give rise to regurgitation are distortion and shortening of the valvular leaflets, these being often associated with alterations in the ostium and the chordæ tendineæ, conditions themselves arising in the majority of instances from an old or recent endocarditis, and especially the variety of the latter due to rheumatism. Atheroma is also observed as a cause, but is more often secondary to aortic disease. Myocarditis sometimes leads to changes in the musculi papillares with resulting insufficiency. Imperfect closure of the mitral valve may also be due to purely muscular conditions (relative insufficiency), and is exemplified in the high degrees of dilatation of the left ventricle occurring in protracted fevers and anæmia. Rupture of the valvular leaflets is a rare though efficient cause. Deposit of lime salts in the leaflets themselves, or at their bases, sometimes interferes with their perfect approximation. Mitral insufficiency occurs with greater frequency in women than in men, and in the young rather than in those of advanced years.

Pathology and Morbid Anatomy.—In the early stages of cases of rheumatic origin the changes are sufficient only to lead to imperfect approximation of the cusps; but as time goes on, the latter become greatly thickened and contracted, and ultimately calcareous matters are often deposited in them or about their bases. Adherence of the edges of the valvular segments to each other further complicates the condition by leading to more or less stenosis of the auriculo-ventricular orifice. The chordæ tendineæ exhibit important pathological changes, being found adherent to the wall of the ventricle, or shortened and even ruptured. In other cases the leaflets themselves are but slightly altered in structure, but have vegetations or concretions adherent to them, and these being more or less movable in the blood current, interfere quite materially with the action of the valve and thereby lead to regurgitation or obstruction. In long standing cases, the valve may be so greatly deformed as to present about the mitral orifice a mere ring of sclerotic or calcareous tissue.

The regurgitation of blood through the mitral valve acts mechanically to produce certain important changes in the heart structure. The immediate result is dilatation of the left auricle, a condition brought about by the admission to the auricle of the regurgitated blood in addition to that which normally comes over from the pulmonary vein. Ultimately this dilatation is compensated in some slight measure by hypertrophy of the auricular walls. The latter, however, are always weak, and capable of but little hypertrophy, hence they remain in an enfeebled condition. The increased blood pressure is not confined to the auricle, but involves the entire pulmonary circuit, even the right ventricle becoming ultimately overdistended, dilated, and greatly hypertrophied. It is in this manner that the mitral leak is compensated. Dilatation and moderate hypertrophy of the left ventricle are often associated, a high degree of hypertrophy of this structure being not uncommon. The changes in this portion of the heart are accelerated by the increased blood pressure in the pulmonary circulation incident to the hypertrophy of the right ventricle, and further by the overfilled and hypertrophied auricle distending the left ventricle. The hypertrophy of the ventricular walls may be sufficient to secure a proper degree of blood pressure in the aorta for years in spite of an aggravated mitral lesion; but in time myocardial degeneration supervenes with increasing dilatation of the left ventricle, aggravated mitral regurgitation, and additional work thrown on the right ventricle, resulting in still further dilatation of that structure, relative insufficiency at the tricuspid orifice, and general venous engorgement.

Symptoms and Physical Signs.—The symptoms attendant upon mitral insufficiency in its early stages depend in great measure upon the rapidity of the development of the lesion. If it is sufficiently slow in progress to permit of a parallel development of compensation, annoying symptoms will be slight or absent; and *per contra*, if regurgitation is rapidly established, as it may be in some cases of intense endocarditis, especially if of the malignant variety, symptoms of most serious circulatory obstruction will appear within a few weeks or even in a few days. These symptoms are due in the main to dilatation of the heart, and the period during which they continue may be said to constitute the stage of primary dilatation. Of symptoms, there may be nosebleed, hæmoptysis, dyspnœa, and evidences of pulmonary congestion or œdema. In extreme cases there may be actual consolidation of lung tissue. The urine is often albuminous, and some degree of anasarca may be present. The stomach may be irritable and the bowels loose. During this period of primary dilatation too little blood is injected into the aorta, partly owing to the loss by regurgitation, and partly because of the enfeebled ventricle. This imperfect filling of the arterial system results in a pulse of small volume, and frequently in paleness and coolness of the general surface. Following upon the primary dilatation there is usually a degree of hypertrophy

which compensates for the leak more or less perfectly, such compensation ofttimes remaining unbroken for many years. During this period —the stage of compensation—which is often one of a fair degree of health, a variety of symptoms of a mild grade may be a source of complaint. Shortness of breath, especially upon exertion, is perhaps the most prominent. The hyperæmic conditions of the lungs tends to attacks of bronchitis, and hæmoptysis is not rare. The face may be slightly cyanotic, and the small veins dilated. These symptoms suggest free regurgitation. Palpitation may be a symptom, and is more frequently observed in young nervous subjects. The finger-ends may be clubbed.

With advancing years, and especially with the advent of middle life and the beginning of degenerative changes, which are often precipitated at an earlier period than normal by depressing disease in any form, degenerative changes in the myocardium occur, and these result in a secondary dilatation of the heart, with a gradual loss of compensation. A long line of symptoms incident to circulatory obstruction follows. The amount of blood in the arterial system diminishes, the veins and capillaries become engorged, the heart's action is weak and irregular, and palpitation may be troublesome. The increasing pulmonary hyperæmia leads to increase in dyspnœa, bronchitis, etc. Expectoration appears, may become profuse, and contain pigmented epithelial cells; the liver swells, and the widespread consequences of portal hyperæmia develop. Catarrhal jaundice may add a yellowish tint to the cyanotic skin. The urine is lessened in quantity and not infrequently contains albumin, casts and blood. The increased cerebral congestion causes mental heaviness, headache and disturbed sleep. A constant symptom in protracted cases is dropsy, due to impoverishment of the blood and to venous engorgement. It begins in the feet, and as it increases, a general anasarca develops with, in some cases, effusion into the different serous cavities.

In the dire state thus depicted the patient may soon die, but more frequently he does not succumb until after months or years of alternate improvement and aggravation have elapsed; for even after compensation has been in great degree lost, judicious treatment associated with rest, results in increased nutrition of the affected organ and may lead again and again to the relief of the most serious symptoms. The fatal issue, which is rarely sudden, may be precipitated by dropsy, often complicated by œdema of the lungs; or the greatly dilated organ may fail to empty its cavities with sufficient force. Less frequently a fatal result is due to hæmorrhagic infarction of the lung or some other complication.

Inspection and Palpation. The præcordial region is often prominent. The apex beat is displaced downward and outward in direct proportion to the extent of the cardiac enlargement. It is common to

find it, however, in the sixth interspace and to the left of the nipple line. The beat differs from the normal in being more diffused, and until dilatation is advanced, it is more forcible than in health. It may also be seen in the epigastrium. If the cervical veins are distended, an undulating pulse may be visible. This sign is especially marked in recumbency. A systolic thrill may rarely be present within a limited area about the apex.

Percussion. The area of dulness is increased in proportion to the enlargement of the heart. This increase is marked, especially in a lateral direction, being often discoverable to the right of the sternum and extending to the left as far as the apex beat.

Auscultation. A murmur of a blowing, rasping, or musical character, which entirely or partially replaces the first sound of the heart, is the special diagnostic feature of mitral incompetency. Its centre of intensity is at the apex. It can usually be traced to the axilla, and over the left aspect of the chest, and be heard even at the angle of the left scapula posteriorly. In exceptional cases the murmur may be widely diffused. The pulmonary second sound is generally distinctly accentuated, a most valuable corroborative sign. The centre of intensity is not always at the apex, but may be somewhat above and external to it. This is due to the displacement upward and backward of the left ventricle, which forms the apex, by the hypertrophied right ventricle (Niemeyer). According to Paul and Balfour the area of greatest intensity may be raised to the second or third left intercostal space. This may be due to the left auricle, which is near the surface in this region. Position may affect the murmur—*e. g.*, it may be inaudible in recumbency, or heard during sitting, or *vice versa*. With great weakening of the ventricle the murmur may disappear altogether. As in valvular diseases generally, the seriousness of the lesion cannot be judged by the character or the intensity of the attending murmur.

Systolic apical murmurs are occasionally the result of blood changes or they may be exocardial—*i. e.*, due to expulsion of air from the overlying lung tissue, and in differentiating, it must be remembered that murmurs of organic origin are also often altered by respiration.

Associated Murmurs. A pre-systolic murmur is sometimes associated with the systolic, and late, after the development of tricuspid regurgitation, a systolic murmur may be heard at the ensiform cartilage, and along the lower left edge of the sternum. According to Paul, the area of this murmur is usually very limited, "not larger than a five-franc piece." Unless a systolic murmur, even if transmitted to the axilla, is persistent and associated with changes in the heart walls, or an accentuated pulmonic second sound, it cannot be considered as absolute evidence of mitral incompetency, as many murmurs of uncertain character possess these characteristics. These murmurs, which are mostly of

intraventricular origin, are not associated with other and stronger evidences of heart lesions.

MITRAL STENOSIS.

Mitral stenosis—an obstruction to the passage of blood from the left auricle into the left ventricle—is due to a variety of pathological lesions, all of which give rise to constriction at the auriculo-ventricular opening. It is by no means as common a condition as mitral regurgitation, with which it is frequently associated. The mechanical result of the lesion on the circulation is overfilling of the pulmonary vessels and consequent increase of tension in the pulmonic and diminished tension in the systemic circulation. The majority of cases are observed in the female sex and are developed early in life, facts which are explained, partially at least, by the greater prevalence of rheumatism and chorea in girls. A congenital origin was at one time assigned to many cases of mitral stenosis, but since the discovery of the fact that the disease sometimes arises so insidiously as to make it impossible to decide just at what time the lesion develops, or even to suggest a possible cause, this view has been greatly modified.

Pathology and Morbid Anatomy.—The anatomical changes involve the valves, their tendinous cords, and sometimes the tissues of the ring. When the former structures are affected they are found thickened, roughened, rigid and calcareous. Variable degrees of fusion of the valve margins and thickening of surrounding tissues take place, thus reducing the orifice to such an extent that it appears as a very small slit, to which Corrigan, the eminent Irish clinician, gave the name "button-hole contraction." In some cases the margins of the valvular segments are bound together and are associated with little or no thickening of the adjacent tissues, in which case the orifice, when examined from the auricular side, presents a circular or flattened funnel-like shape projecting into the ventricle. Stenosis arising from changes confined almost exclusively to the tissues at the base of the valve, is rarely observed.

Dilatation of the left auricle follows upon the establishment of the obstructive lesion if the stenosis is developed rapidly, and is succeeded by hypertrophy later. If, on the other hand, the lesion is more slowly developed, there is dilatation with steadily progressive hypertrophy. These, then, are the first accessory heart changes to develop. The dilatation may be extreme, so that late in the disease the walls of the auricle become very thin. Coincident with auricular changes there is increase of blood pressure in the pulmonary circulation, and this in turn produces dilatation and hypertrophy of the right ventricle. Tricuspid regurgitation and congestion of the systemic veins are late developments and the result of extreme dilatation of the right heart. As in the case of the left auricle, the rapidity of the development of the primary lesion will deter-

mine the extent to which dilatation and hypertrophy of the right ventricle prevails in the early history of the case.

Aside from the anatomical peculiarities, the principal difference between mitral incompetency and stenosis resides in the condition of the left ventricle, which in pure mitral stenosis takes but little part in the general enlargement of the heart, owing to its diminished blood supply. Whatever dilatation or hypertrophy is developed in it, results from a co-existing mitral insufficiency. In no case is the increase in the weight of the heart apt to be great. Pulmonary hyperæmia and sequential tissue changes are more prominent features of mitral stenosis than of any other cardiac affection. The hyperæmia and general sclerosis of the pulmonary parenchyma and of its nutrient vessels are associated with pigmentation, and develop the conditions known as cyanotic induration, thrombosis, and hæmorrhagic infarctions. In a case of mitral stenosis occurring in my practice, the obstruction developed so rapidly that, added to the intense pulmonary hyperæmia, there was blanching of the surface of the body, cool skin and other evidences of unfilled arteries. The enlarged feeble auricle is sometimes found to contain ante-mortem thrombi, and several times large free globular thrombi of this character have been observed. Marked degrees of mitral stenosis cannot be compensated for any great length of time; slight lesions may be overcome for many years.

Clinical Course and Physical Signs.—Inspection. As mitral obstructive lesions often occur in young subjects with yielding thoracic walls, the enlarged right ventricle sometimes leads to prominence of the lower portion of the sternum, and of the fifth and sixth left costal cartilages. Later, when hyperæmia of the liver has developed, prominence in the epigastric region is also observed. The apex beat is usually found in the normal position, but inclines to weakness and may even disappear. Sometimes it is found further to the left, or lower than normal, thus indicating hypertrophy of the left ventricle, resulting from an associated mitral incompetency. Pulsations of the left auricle are sometimes visible, especially if tricuspid insufficiency has developed. Systolic pulsation of the cervical veins possesses the same significance. In the final stages, there are cyanosis and other evidences of venous engorgement.

Palpation. The heart's impulse is feeble and may be felt in the epigastrium. Pulsations of the auricle may also be felt. A diastolic or presystolic fremitus, or purring thrill, felt at the apex, is the most important sign developed by this method of examination, and is highly diagnostic of mitral obstruction. It is best appreciated in certain positions of the body, *e. g.*, the left lateral decubitus, and appears and disappears as the force of the heart's action is increased or diminished. The thrill terminates abruptly with the beginning of the systole.

The arterial pulse is small, owing to the imperfect filling of the left ventricle, and the consequent injection of too small a quantity of blood

into the systemic vessels. With failing heart power comes arrhythmia and intermittent pulse.

Percussion. As the alterations in the cardiac walls are especially pronounced in the right ventricle and the left auricle, the increase in percussion dulness is mainly to the right of the apex and upward along the left sternal border. The line of dulness on the right side may be extended even as far as the nipple line.

Auscultation. The murmur of mitral obstruction has been the subject of considerable discussion of late years. It is produced by the blood current in its passage from the left auricle into the corresponding ventricle, and must therefore be diastolic in time. But while it may occupy a considerable portion of the diastolic period, it is usually developed towards the close, *i. e.*, during the auricular systole, ending abruptly with the beginning of the ventricular systole. This led M. Fauvel, who first described this murmur, to designate it "presystolic," a term which still remains the most frequently used appellation by which the murmur is described. It has been observed in some instances to occupy only the diastole, *i. e.*, to occur with the beginning of the auricular systole. The murmur is prolonged and usually described as rumbling, grinding, or vibratory, and is usually sharply localized within the apex area or just above it. Some observers describe it as nearer the median line. It is not conducted to the axilla nor is it heard posteriorly. Intensification of the pulmonary second sound suggests hypertrophy of the right ventricle. Matterstock states that the sound is frequently transmitted into the axillary and subclavian arteries. If greatly intensified, the pulmonary second sound may be heard loudly at the apex. The small amount of blood pumped into the aorta accounts for the feebleness of both sounds over this vessel. Flint's observation of an apical presystolic murmur in rare cases of aortic insufficiency has been corroborated. The abruptness and intensity of the first sound has been variously explained, but seems to be due mainly to the forcible closure of the tricuspid valve, caused by the hypertrophy of the right ventricle. This feature is so constant that it is suggestive of mitral stenosis even when the murmur diagnostic of that lesion is absent. With loss of compensation the presystolic murmur and the thrill frequently disappear. A sharp first sound remains. The presystolic murmur varies greatly in intensity and may be appreciable only during periods of circulatory excitement. Mitral stenosis has been frequently discovered *post-mortem* without the murmur having been detected during life. Fagge observed it in forty autopsies. Both heart sounds may be reduplicated, but the second much more frequently. This is due to the difference in tension of the two systems, the pressure being much higher in the pulmonic circuit; and further, to hypertrophy of the right ventricle, and a certain want of synchronism in the action of the ventricles. The overgrowth of the right

ventricle may be sufficient to compensate the obstruction at the mitral orifice for many years.

As in mitral incompetency the patient may be free from annoying symptoms for a long period of time, the obstruction at the mitral orifice being fully compensated by hypertrophy of the right ventricle. Some shortness of breath upon exertion, a feeble pulse, and a little cough, may be all the symptoms attracting attention to the heart. As in other valve lesions the patient is liable to embolism and its consequences. Recurring endocarditis may take place with consequent aggravation of symptoms. The engorgement of the venous system resulting from a decided break in compensation, and the resulting changes in the various organs has been sufficiently described under "mitral incompetency."

Aortic Disease.

A variety of changes at the aortic orifice leads to two well-defined forms of valvular disease. In one the aortic valves become incompetent to close the orifice, regurgitation of blood into the left ventricle resulting, while in the other, there is developed an obstruction to the outflow of blood from the ventricle, *i. e.*, aortic stenosis. These two conditions may exist singly or combined, generally the latter. Even then one condition frequently predominates so markedly over the other as to give to the resulting disease its special features.

AORTIC REGURGITATION.

Aortic regurgitation, sometimes designated "Corrigan's Disease," is to a peculiar degree an affection of active men in middle life. Though not by any means as frequently observed a condition as mitral regurgitation, it is, next to that variety, the most frequent form of valvular disease of the heart. Diseases which lead to distortion of the valves or of the ostium are especially sclerosis and endocarditis. The former is, of course, a chronic pathological process, and is often apparently dependent upon gout, syphilis, alcoholism, etc., and is by far the most frequently observed cause. Endocarditis, due to rheumatism, though also a cause, far more frequently produces mitral than aortic disease. The endocarditis associated with the infectious fevers is also more frequently located at the mitral orifice. Malignant endocarditis on the other hand *does* frequently attack this valve and bring about an incompetency through ulcerative action. Occurring under these circumstances, aortic regurgitation, as a rule, proceeds rapidly to a fatal issue. Strain occupies a prominent etiological position, so prominent indeed that the appellation "athletes' heart" is often applied. The immediate effect of excessive exertion is an increase of the blood pressure upon the aortic valves during the heart's diastole. Excess in running, rowing, striking, or in any laborious employment or athletic exercise may be sufficient to excite inflamma-

tory, degenerative, or traumatic changes, and consequent regurgitation. Extremes in heat and cold are favoring conditions. Circumstances of life calculated to lessen the amount of oxygen breathed, and favor the development of the gouty diathesis, sclerosis and fatty change, are also important predisposing factors. Rupture of the valves may be the immediate cause of incompetency, but such valves are usually previously degenerated. Dilatation of the ostium may cause a relative incompetency, a condition which may develop in aortic aneurism.

Morbid Anatomy.—It is unusual to discover the aortic valves so altered as to result in obstruction to the blood current without the presence of regurgitation. The reverse cannot be stated, for incompetence frequently exists without obstruction. There is the greatest variation in the condition of the parts. In the simplest character of the lesion, *i. e.*, in recent rheumatic changes, there may be simply a line of pinkish vegetative developments near the edge of the valves. At the other extreme there is almost complete disappearance of these delicate structures, what remains being of a hard cartilaginous character or infiltrated with calcareous matter. Less often the valves are in some degree united at their edges, and may, under these circumstances, especially if the adhesions are towards the corpora aurantii, project in a dome-like fashion into the aorta.

The diseased valves are in various degrees sclerotic, leading to thickening, curling, puckering and retraction. It is not rare for a deposit of calcareous matter to take place in the diseased tissues, or for atheromatous changes to be superadded. In old cases the valve leaflets may be almost entirely destroyed, being represented by irregularly distorted projections about the orifice.

The immediate effect upon the heart of the establishment of aortic incompetence, especially if it be developed rapidly, is dilatation of the left ventricle, which is often of very high degree. This is, however, quickly followed by hypertrophy of that portion of the heart, which is apt to be greater in degree than that occurring in association with any other form of cardiac disease. It is this extreme condition of dilatation and hypertrophy to which the older writers applied the term "cor bovinum." In well marked cases, the ventricular walls may increase to an inch or even more in thickness.

With dilatation of the ventricle the mitral ostium sometimes becomes sufficiently distended to produce a relative mitral insufficiency followed by dilatation of the left auricle, and ultimately by hypertrophy and dilatation of the remaining heart cavities. In time degenerative changes take place in the heart muscle, and the compensation which may have been well maintained for many years, is gradually lost. The arteries generally are frequently in a state of arterio-sclerosis, induced partly by the causes of the aortic lesion, and also in part by the strain

brought to bear on them by the powerful action of the hypertrophied left ventricle. The powerfully acting heart and the degenerated blood-vessels furnish two factors for additional lesions, namely rupture of vessels and sanguineous extravasations, these occurring with especial frequency in the brain.

Aortic regurgitation from congenital malformation is rare.

The immediate effect of aortic leakage is to decrease the amount of blood in the arterial system and increase that in the venous. This result is fully impressed on the observer by the character of the pulse which will be shortly described.

Dilatation of the aorta is not an uncommon attendant upon aortic regurgitation.

Symptoms and Physical Signs.—For a time compensation may be so perfect that extensive aortic lesions may fail to excite annoying symptoms. It is not uncommon for the condition to be discovered accidentally in persons who have not even been suspected to be subjects of disease of the heart. In the period before hypertrophy is established, the pulse is small and jerky, owing to imperfect filling of the arteries.

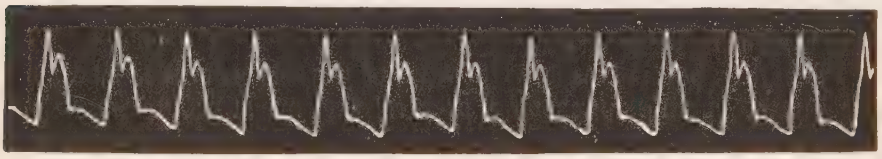


FIG. 10.—PULSE OF AORTIC REGURGITATION.

The venous system becomes abnormally distended, both the systemic and pulmonary circuits being involved, and thus we have symptoms arising from various degrees of venous obstruction. The extent to which the venous congestion is carried is in direct proportion to the degree of dilatation of the left ventricle. Cyanosis, dyspnœa, dropsy, congestion of internal organs, etc., are the most important attending symptoms of this period of the disease.

With the establishment of hypertrophy, the arteries are better filled, and the veins are relieved somewhat of their congestion, consequently the pulse becomes stronger, although it still preserves its jerky character. The symptoms of pulmonary and other internal congestions disappear or diminish. If the right heart has been dilated, it also undergoes hypertrophy. In this stage of compensatory hypertrophy, the patient appears in good health, unless, as happens unfortunately in some instances, the hypertrophy exceeds that which is required for the performance of normal function, in which case palpitation, cardiac distress, angina pectoris, congestion of the brain or lungs, cardiac asthma, etc., may be present.

With failure of compensation, which sooner or later occurs as the result of the progressive character of the valve lesion, mitral incompetence or degenerative changes in the heart walls, there is a return of the conditions of the early period, namely, dilatation and its consequences. With varying rapidity the symptoms of venous stasis in the different organs appear, death resulting from pulmonary œdema, cerebral hæmorrhage, embolism of the middle cerebral arteries, or general exhaustion.

Pain is a common, indeed it may be an early, symptom of aortic regurgitation. Its character and location are variable. It may be confined to the cardiac region or it may radiate into the neck or arms, more particularly on the left side. Attacks of angina pectoris are common features, occurring rather more frequently in aortic incompetence than in any other variety of valvular disease. This in part explains the greater frequency of sudden death in aortic regurgitation than in any other variety of valvular disease of the heart.

Of the train of symptoms developing with failing compensation, dyspnœa and dropsy deserve special mention. The latter is manifested especially in the feet, general dropsy being unusual. Hæmoptysis, œdema of the lungs, some elevation of temperature, due usually to waves of endocarditis, symptoms due to embolism of various organs, and hæmaturia, show the serious condition of affairs. The patient's nights are bad, as he is forced to sit upright to obtain a minimum of discomfort in breathing. Sleep is also disturbed by annoying dreams, and mental aberration with a suicidal tendency is not uncommon.

Inspection. An increased prominence of the præcordium is observed in young subjects. The apex beat is displaced downward even as far as the seventh or eighth interspace, and to the left, even as far as the mid-axillary line. The heart's impulse is heaving in character and abnormally extended. Of this symptom as a subjective one, the patient may make no complaint. The more exposed arteries are readily discovered to be dilated, tortuous, and to pulsate with increased force. Indeed, the readiness with which arterial pulsations may be seen, has often been a means of directing early attention to the disease. Corrigan described this symptom under the name of the "visible pulse." To use his own words: "The arterial trunks of the head, neck, and upper limbs, at once attract the eye by their peculiar pulsations. At each diastole, the subclavian, carotid, temporal, humeral, and sometimes even the palmar arteries, are projected forcibly from their beds, and bound under the skin. These pulsations are observed sometimes in healthy individuals, particularly after violent exercise, but in the affection under consideration, the movement of propulsion is excessive in amount." Ophthalmoscopic examination sometimes shows marked pulsation of the retinal vessels; indeed, aortic incompetence has been correctly anticipated by this symptom, when its

existence had not previously been suspected. Even the capillaries, according to Quincke, may sometimes be seen to pulsate after making pressure upon the skin of the forehead with a blunt instrument, the line developed by the pressure becoming alternately pale and red. Active pulsations along the right edge of the sternum in the second right intercostal space may be present, and suggests dilatation of the ascending aorta.

Palpation. By palpation we are enabled to corroborate most of that which has previously been learned by inspection. In addition a diastolic thrill may be detected in the aortic area, *i. e.*, in the second right intercostal space near to the sternum. This sign, however, is often absent. The arterial pulse is characteristic and has been variously described as the "water-hammer" pulse, the "pulse of unfilled arteries," and "Corrigan's pulse." It is a pulse in which the arteries fill suddenly, but the distention is not sustained, consequently the vessel collapses immediately. A sphygmographic tracing exhibits an abrupt and excessive rise due to the forcible projection of the blood current by the hypertrophied ventricle, succeeded by a rapid fall as the blood regurgitates into the ventricle at the same time that it passes on into the capillaries. The dicrotic wave is not well marked. The characteristics of the water-hammer pulse become more pronounced if the hand is held above the head.

It must be kept in mind that complications of various sorts modify the pulse of aortic incompetency. This is especially the case when lesions of other valves are present, or when the changes in the aortic valves are sclerotic and the same condition exists in peripheral arteries.

Percussion. The area of cardiac dulness extends downward and to the left proportional to the degree of hypertrophy of the left ventricle. An extension of dulness to the right of the sternum is observed only in a later stage, when the right heart has become considerably hypertrophied. Dilatation of the aorta may give rise to dulness within the aortic area.

Auscultation. A diastolic murmur of most variable character, intensity and pitch, heard within the aortic area, is the auscultatory feature of this lesion. The point of greatest intensity is variable. It may be within the pulmonary area, more frequently over the ensiform cartilage, or in the fourth left interspace near to the sternum. Hyde Salter and others have reported cases in which the murmur was heard at the apex only. In most cases falling under my own observation the murmur has been most distinctly heard in the second right interspace close to the sternal edge, or at the junction of the second right cartilage with the sternum, being traceable down the sternum or toward the apex, and often in some degree being transmitted along the great arterial trunks. This is in harmony with the statements of most authorities. Paul states that the location and propagation of the murmur vary with the advance of the disease. This I have been able to corroborate in a remarkable case which has been under my care for fourteen years.

The systolic murmur of aortic obstruction is frequently associated with that of regurgitation. Less frequently the murmur of mitral regurgitation occurs and is due to a relative insufficiency established through dilatation of the left ventricle.

Prognosis.—Aortic regurgitation, if uncomplicated, may exist for many years without causing annoying symptoms, or incapacitating the patient from pursuing an active life. The degree of insufficiency cannot be judged by the character of the murmur. According to Sansom, strong arterial pulsations and the ability to develop the capillary pulse, especially if associated with pallor of countenance, and the rounded apex outline of dilatation, indicate a considerable lesion.

The evidences of aortic regurgitation may disappear. This has been observed when the lesion has been limited to one or two leaflets, and the distention of the normal or less injured one becomes finally sufficient to close the orifice.

If general cardio-vascular sclerosis can be excluded, the prospect of long continued life is much greater; but in well-marked cases of sclerosis, the tendency to progressive involvement of the aortic tissues, and of the coronary arteries with mural changes, indicate the possibility of the appearance of serious symptoms at any time.

AORTIC STENOSIS.

Uncomplicated aortic stenosis is seldom seen, being usually associated with aortic insufficiency. Lesions diminishing the lumen of the aortic outlet obstruct the outflow of blood and give rise to hypertrophy of the left ventricle. Dilatation appears in the advanced periods. The mitral ostium may be sufficiently enlarged to develop a relative insufficiency at that orifice. Following upon this the left auricle may dilate, and this in turn leads to hypertrophy of that portion of the heart. The



FIG. 11.—PULSE OF AORTIC STENOSIS.

obstruction in the pulmonary circulation eventually results in hypertrophy of the right ventricle. The nature of the lesions producing the obstruction has already been sufficiently dealt with (see page 74). The resulting changes in the ventricle are of the same kind, but are rarely of as high a grade as in aortic regurgitation. The periods or stages are also the same as in aortic incompetence, with the difference that the primary dilatation is slight or often practically absent. As the hyper-

trophy and dilatation are usually less than in incompetence, the symptoms of congestion in various organs are decidedly less pronounced.

Symptoms and Physical Signs.—Inspection. The apex beat is displaced downward and to the left in proportion to the amount of hypertrophy of the left ventricle, but unlike that in aortic incompetence, is not usually characterized by strength. If the chest wall is rigid, or the lungs are emphysematous and large, the heart's impulse may be obscured. The præcordial region may be distended if the chest walls are elastic and the hypertrophy considerable.

Palpation. The systole, owing to the extra time required for the ventricle to empty itself, is slow in evolution and appears weak. The impulse may be feeble, absent, or retarded and heaving. A systolic thrill is sometimes felt most distinctly in the aortic area, but it may extend to the apex and be even more widely diffused. The arterial pulse is small, hard, and rather slow. It is a "tardy" pulse. Sphygmographic tracings exhibit a slow rise and fall, and the apex of the curve is rounded. The slowness of the pulsation was explained by Traube as the result of insufficient supply of blood to the coronary arteries due to the stenosis. While compensation continues, the pulse rhythm is usually undisturbed. The pulse tends to slowness, is small but regular, and of fair tension.

Percussion will usually demonstrate an enlargement of the heart downward and to the left, but the area of dulness is rarely as extensive as in aortic regurgitation.

Auscultation. The first sound of the heart at the base is replaced by a murmur which is continued into the arteries of the neck. The point of greatest intensity is in the second right interspace, close to the border of the sternum. The systole is distinct at the apex. An aortic regurgitant murmur is also usually present, but when absent, the second sound may be indistinct at the base, owing to changes lessening the elasticity of the aortic leaflets. A murmur identical as to location and diffusion may result from a variety of conditions, and only a comprehensive view of the case is sufficient for a diagnosis; indeed a diagnosis is sometimes impossible. Roughening of the aortic valves, changes in the tunica intima of the aorta, aneurism of the ascending portion, and rarely, a high grade of anæmia, are the best known causes of this murmur. The murmur of stenosis is usually of a louder and harsher character, and is also supposed to be more often musical than that of incompetence.

TRICUSPID INSUFFICIENCY.

Insufficiency of the tricuspid valve resulting in regurgitation of blood into the right auricle, in most instances is due to dilatation of the tricuspid ring, secondary to mitral or chronic pulmonary disease, and is therefore relative in nature. We have seen that in mitral disease hypertrophy of the relatively weak right ventricle is preceded by dilatation

if the lesion is rapidly developed, and succeeded by the same process when the cardiac muscle degenerates. It is during these periods of dilatation that the enlarged ventricle fails to bring the leaves of the tricuspid valve into apposition; consequently regurgitation results. The lesion under consideration appears to be of rather uncommon occurrence, still, Bramwell found in a series of cases of acute endocarditis, the tricuspid valve affected in more than one-third of the cases, the rarity of permanent damage to the valve being attributed by him to the complete cure of the inflammation because of the comparatively small strain to which this valve is subjected. Some cases are congenital and are believed to arise from fœtal endocarditis. When tricuspid regurgitation does follow endocarditis, it will nearly always be in very young subjects. Rupture of the valvular leaflets may result from strain, but is rare.

In tricuspid regurgitation the amount of blood injected into the pulmonary artery is lessened and a certain portion of that fluid is forced backward through the right auriculo-ventricular orifice into the right auricle. This compartment then dilates or hypertrophies in proportion to the amount of blood regurgitated, and the rapidity of development of the incompetency, stasis in the venæ cavæ resulting. As there is nothing to prevent the influence of the contractions of the right ventricle from being exerted upon the blood in these vessels and tributaries, a venous pulse in the neck becomes perceptible. With enfeeblement of the ventricle, these systolic venous pulse waves diminish and disappear. It is not rare to find this sign more widely diffused, being appreciable even in the superficial veins of the chest. The veins of the neck often manifest a high degree of engorgement, especially upon the right side, which is more prominent during exertion, and especially upon coughing. Another interesting feature—hepatic pulsation—results from the extension of the pulse waves through the inferior vena cava to the hepatic vein with systolic swelling of the liver. Cyanosis finally becomes a prominent symptom, and is followed shortly by death.

Physical Examination.—Inspection. The lower sternal and the epigastric regions may be prominent and pulsating. The latter region may even present a tumor, which is quickly formed, if the dilatation has developed rapidly. The left lobe of the liver shares in the formation of the apparent tumor. The apex beat is removed to the left when mitral incompetence and consequent hypertrophy of the left ventricle are associated.

The apex may be removed from the chest wall by the enlarged right ventricle. Pulsations appear in the jugular and cervical veins. Early, the jugular pulsations are observed in the lower portion of the neck, but as the valve in this region becomes incompetent the pulsations are extended to the portion of the vessel above. The cervical vein

pulse is sometimes double, and the pulsations are more distinct when the breath is held in expiration. The true cervical pulsation may be distinguished from pulsations communicated from the carotid artery beneath by compression of the vein which arrests pulsation in the distal portion of the vessel.

Palpation. Unless the left ventricle is hypertrophied the impulse is feeble, and may disappear after the right ventricle is sufficiently enlarged to remove the apex from the chest wall. Systolic pulsations are common in the epigastrium and in the liver, especially the former. The spleen still less frequently presents the same symptom. The pulsations of the liver are distensile, often visible, and a highly interesting phenomenon. Swelling of the liver and spleen are often detectable by touch. A systolic thrill may be felt in the epigastrium.

Percussion. Dulness is increased to the right and upward, often reaching as high as the second right interspace, and may be increased also in the epigastric region.

Auscultation. The murmur attendant upon tricuspid regurgitation (not invariably present) is systolic in time and heard at the right inferior border of the heart, especially over the lower portion of the sternum. The area of greatest intensity is the left border of the sternum in the space between the fourth and sixth ribs. Some observers state it to be the base of the ensiform cartilage. Loomis asserts that this murmur is never audible above the third rib. Its character is variable, being often superficial in character and generally soft and of low pitch. At times it is very feeble and may entirely disappear. The systole is usually obscured when the murmur is intense, but at the same time may be not at all impaired at the apex. Mitral murmurs often coexist, and are differentiated by the localization and extension, as well as by differences in quality, pitch, etc.

Symptoms.—As tricuspid regurgitation is usually secondary to some chronic affection of the lungs or left heart, it follows that the symptoms will be more or less associated with and obscured by those of the primary affection. When the circulation is sufficiently obstructed to lead to engorgement of the viscera, symptoms indicative of this condition appear. Symptoms referable to the heart may not be pronounced, but with free regurgitation there may be palpitation, shortness of breath, irregularity, intermittence, and various disturbances of rhythm. The right pulse may be weaker than the left, due to pressure of the dilated right auricle and venæ cavæ upon the innominate artery. The engorged liver may give rise to a sense of fulness and ill-defined pain, and may even develop interstitial hepatitis. The stomach is disordered, and the distended vessels may rupture, giving rise to hæmatemesis. The kidneys yield a urine of a high gravity, dark in color, which is often albuminous in the late stages. Tube casts and other evidences of renal degeneration

may be associated. The cerebral engorgement is attended by headache, vertigo, and disturbance of the mental operations. General anasarca, which is a feature of this period, begins about the ankles, but rarely involves the genital organs.

TRICUSPID STENOSIS.

The extreme rarity of stenosis at the tricuspid orifice renders this valvular anomaly of but little practical importance. Paul takes the ground that it never occurs as an uncomplicated condition, although Fothergill, Foster, and Haldane, think differently. It is usually a congenital condition, and is apt to be associated with other developmental defects. That the lesion may be acquired is strongly supported by Leudet's and Fenwick's collection of 160 cases from various sources, in more than one-third of which a history of rheumatism was obtainable, and a majority of which had reached adult life at the time of death. The very frequent association of mitral stenosis with this lesion, and its very great predominance in women, are especially notable features. The hyperplastic and stiffened valve leaflets are usually adherent to each other. Hypertrophy of the right auricle is the earliest secondary change, and in time the back pressure causes venous engorgement of the various organs. The right ventricle becomes hypertrophied, if a lesion coexists at the mitral orifice. The physical signs consist of a diastolic or presystolic murmur heard over the right heart—Paul, to the contrary, asserting that this murmur is never diastolic or presystolic—and most distinct at the ensiform cartilage. The almost constant association of other lesions, however, makes the probability of meeting this murmur dissociated, very slight. It is often impossible to differentiate between a tricuspid direct and mitral direct murmur. Aside from the characteristic murmur, percussion evidences of dilatation of the right auricle may be elicited, and palpation may show a presystolic thrill over the lower part of the sternum.

AFFECTIONS OF THE PULMONARY VALVES.

Chronic lesions of the pulmonary valves are usually congenital; acute usually arise from malignant endocarditis. This class of cases constitute the least frequent form of valvular disease of the heart. Murmurs developed at this orifice are usually due to blood changes and therefore are functional in character. Endocarditis involving the pulmonary area is exceedingly rare except during fœtal life. Atheroma is nearly as unusual, affecting the artery oftener than it does the valve. In congenital deformity, the valves may be distorted and adherent at their edges. Pressure upon the pulmonary artery of neoplasms, swollen bronchial glands, an aneurism, or a consolidated lung, may develop obstruction. Loomis states that the murmur of pulmonary obstruction has been induced by cardiac thrombosis.

PULMONARY STENOSIS.

The murmur is systolic, limited to a small area, and heard in its greatest intensity in the second left intercostal space near the sternum. It is seldom heard down the sternum or over the vessels of the neck. Its quality is usually harsh, and its location superficial. When diffused it is in the direction of the left shoulder. The *bruit de diable* may be heard over the jugular veins. The pulmonic second sound is weakened by decrease of tension in the pulmonary circuit. A systolic thrill may be present.

Diagnosis.—This must as a rule be uncertain, on account of the variety of causes, independent of disease of the pulmonary valve, leading to a murmur of the character described.

The symptoms are uncertain, and those observed in the few cases which have been recorded were not peculiar.

The most important result to the heart is hypertrophy of the right ventricle, and if the succeeding dilatation is sufficiently great, a relative insufficiency of the tricuspid valve, dilatation of the right auricle, and increased blood pressure in the venæ cavæ follow.

PULMONARY INSUFFICIENCY.

This is also an affection of great rarity concerning which we possess little information, most statements relating to it being based more upon theory than observation. The right ventricle hypertrophies and dilates, the symptoms depending much upon which factor predominates. A relative insufficiency of the tricuspid valve may develop secondarily. A diastolic murmur heard in the second right interspace and conducted down the sternum, is present, and possesses a similarity to the murmur of aortic regurgitation. There is, however, an absence of the peculiar pulse of the latter affection.

Involvement of More than One Orifice. — "*Combined Heart Disease.*" In about 50 per cent. of all cases of valvular disease of the heart, there is a combination of two or more forms. Most frequently there is contraction of the orifice, associated with changes in the valve leaflets, resulting in insufficiency. We therefore observe quite frequently, especially at the mitral or aortic orifices, combined obstruction and regurgitation. Less often two or more valves may be involved. It is generally possible to indicate the primary lesion, which is also, as a rule, the more important one. The symptomatology is made up of the combined symptoms of the individual forms. The association of these symptoms leads to some degree of modification, certain ones being intensified while others are neutralized.

GENERAL CONSIDERATION OF THE SYMPTOMS AND SEQUELÆ OF VALVULAR DISEASE OF THE HEART.

Symptoms Immediately Associated with the Heart. With fully developed compensation there may be for a long period of time an absence of symptoms attracting attention to the heart, its rhythm, force, and frequency, approximating to the normal. In most cases, however, careful examination reveals some increase in frequency, and, a more marked feature, a very ready increase resulting from exertion, excitement, etc. With some forms, especially aortic stenosis, a persistent reduction of the heart's pulsations may occur. Marked increase in frequency, whether persistent or paroxysmal, suggests disturbed innervation of the organ. In the later stages, increased frequency is the especial result of increased feebleness. The increase in frequency may be associated with arrhythmia in some of its forms. Great paroxysmal increase in frequency—tachycardia—is an occasional feature, particularly of mitral lesions. The rate of pulsation in these interesting attacks may be as great as 180 or 200. We have seen the pulse actually uncountable under these circumstances. Tachycardia often occurs in connection with well compensated lesions, and in hearts which at other times are normal. These attacks may or may not be associated with distressing sensations referred to the organ. Their onset and decline may be rapid. The cause is uncertain, but they appear to be the result of disturbed innervation, probably a temporary derangement of the inhibitory nerve.

Disturbances of rhythm indicate an involvement of the nervous apparatus of the heart, and are of more significance than variations in frequency. According to Baumgarten they are due to morbid alterations in the heart walls, also of the cardiac ganglia, but as apparently the same changes may be present without attending rhythmic alterations, it must be confessed that the subject is not yet well understood. It is possible that conditions of the central nervous system may act in association with the heart lesions. The phenomena of arrhythmia are more apt to appear with the break in compensation, but there are many exceptions. It is remarkable that the regularity of the pulse may in some cases be preserved even up to a fatal termination. Mitral disease calls forth this symptom more frequently than any other form of valvular affection. The varieties of arrhythmia are considered in the section devoted to that subject.

Failure of Compensation. Various factors determine the occurrence of failure in compensation, the most important of these being changes in the heart muscle incident to impaired nutrition. Probably too much importance has been attached to this condition, as we frequently observe hearts presenting high degrees of fatty and myocarditic changes which beat regularly and with a fair degree of force, hearts

capable of sufficient force to carry on the circulation, while, *per contra*, the muscle of a heart which has failed may appear quite free from such deteriorating conditions. The break-down in heart power may appear gradually or with a surprising suddenness. I have observed the latter occur repeatedly in the course of acute infectious disease, and also after most injudicious exertion.

The special evidence of insufficient compensatory power on the part of the heart is stasis in the circulation, which condition may exist in the pulmonary or systemic circulation, or in both.

Stasis of blood in the various organs gives rise to important groups of symptoms. The prominence of one or the other group varies, and cannot always be accurately predetermined for a given case of disease of the heart, although it will be seen that certain organs are specially liable to suffer as a result of lesions of particular valves. For instance, mitral stenosis is most prominent in the production of engorgement of the lungs, and tricuspid regurgitation in the development of engorgement of the abdominal viscera. Of the symptoms indicative of stasis, possessing a general character, the most important are cyanosis and dropsy. General engorgement of the venous system is attended by some degree of *cyanosis*. This may be so slight as to require care and the experienced eye for its recognition, or so pronounced that the patient presents a bloated, bluish, horrible appearance. It is best observed in certain portions of the face, viz., in the lips, cheeks, and alæ of the nose. It is also observable beneath the finger-nails. The bluishness increases with the failure of the heart's efficiency, but may be antagonized by a coexisting anæmia, this being the case, especially in certain instances of aortic disease. Cyanosis usually appears earlier and is more pronounced in mitral than in aortic disease. Pulsations appear in the prominent over-filled jugular vein, and the cervical veins and the venous system generally are engorged. In addition to bluishness of the skin, it is often observed that the superficial veins are dilated, and that ulceration may be associated, especially in the lower extremities. A jaundiced condition of the skin is not uncommon owing to obstructive catarrh of the bile passages, or to embolism of branches of the hepatic artery. Cutaneous extravasations, hæmorrhage, of an embolic origin, or hæmorrhage due to increased blood pressure, altered blood, and degenerate bloodvessels and tissues, occur infrequently.

Dropsy. The persistent high pressure in the venous system more than any other condition is the cause of transudation of the blood serum into the connective tissues, and occasionally into the serous cavities; although deteriorated blood, especially from loss of solids, and consequent impairment of the vessel walls, exert an important influence. In the early stages the lymphatics are able to remove the excess of fluid in the tissue spaces, but with increasing engorgement and exudation, they are finally unable to perform all they are called upon to do, and the result

is an increasing accumulation of serum in the tissues. At first the œdema disappears during the night, but soon becomes a constant feature, especially in dependent portions of the body. The first appearance of dropsy is usually about the ankles or upon the upper portions of the feet. The loose tissues about the eyes or in the scrotum are soon attacked and anasarca becomes general. Still later the pleural, peritoneal, and pericardial cavities, may contain effusions.

Dropsy is not only debilitating, as the result of the withdrawal of so large an amount of nutritive material from the circulation, but by the pressure of the accumulated fluid upon the superficial vessels it still further obstructs the circulation. Collections of fluid within the serous sacs compress the lungs, heart, etc., and increase symptoms, perhaps already distressing or alarming.

When the nutrition of the skin is sufficiently disturbed, erythematous patches or blisters may appear with cracks and discharge of the fluid beneath. Phlegmonous inflammation of erysipelatous origin, ulceration and gangrene, are more serious complications occurring occasionally. The slow circulation leads to a cool skin, and the general temperature may be below normal. Localized coldness may occur as the result of embolism or thrombosis of a vessel of size.

Embolism is not an uncommon feature of valvular disease of the heart, portions of vegetations upon the valves, and particles of fibrin which have formed upon the same, also portions of thrombi, may be transported from the left heart to the brain, where they are most apt to be arrested in the left middle cerebral artery, resulting in an apoplectic seizure and right hemplegia associated with aphasia; or, if lodgment is found in the extremities, there is sudden development of pain, coolness, and the general evidences of cessation of the circulation below the point obstructed. Unless collateral circulation is established, gangrene will result. On account of the less acute angle at which the left iliac artery is given off, the left leg is more often involved. Should both lower extremities be gangrenous it indicates obstruction in the aorta usually just above its division into the iliacs, although it is stated that obstruction of both iliac vessels has been observed. Involvement of the upper extremities gives rise to the same character of symptoms, *i.e.*, symptoms of sudden obstruction of the circulation below a given point. In embolism of the extremities a diagnosis may be assisted by tracing the large arteries toward the body, in which manner one will arrive at last at a point where the pulsations are normal, thus locating the seat of obstruction.

Embolism of the *retinal arteries* is rare, chiefly on account of the arteries supplied to the retina being given off at right angles (ophthalmic, central artery of the retina). The opthalmoscope reveals a narrowing of the retinal vessels with an appearance of an interruption or an irregular

progression of the blood current. There is redness of the macula lutea, the region of the optic papilla is clouded, and the optic nerve may undergo atrophy.

Embolism of the *spleen* is ushered in by a chill, followed by fever, vomiting, sweating, etc., with acute enlargement of the organ. The kidneys may become affected. The urine is then bloody and albuminous, and there are renal pains and tenderness. Embolism of the *hepatic artery* develops a symptomatology much like that of parenchymatous hepatitis. Obstruction of the *mesenteric arteries* is suggested by symptoms resembling those of peritonitis, viz., severe pain of sudden onset, tenderness, sanguineous stools, and collapsic phenomena.

Lungs. Shortness of breath is a common symptom, and is aggravated by exertion, excitement, etc. It is subject to paroxysmal aggravation in some cases (cardiac asthma so called). The attacks are frequently nocturnal. Compression of the lung by an enlarged heart which is enumerated by some observers as a cause of shortness of breath, I think can have but little influence, as larger areas of lung tissue may be rendered impervious to air from other causes without marked dyspnœa. Accumulated effusions within the pleural or pericardial sacs, or upward pressure from a distended stomach, or peritoneal effusion, may sometimes be factors; but to the impeded blood current in the pulmonary circuit must we look for the especial cause, to which may be added bronchitis, and rarely, hæmorrhagic infarctions. Compression of the left primitive bronchus by a dilated left auricle has also been observed as a cause of dyspnœa. Hæmoptysis is a not unusual symptom, especially in affections of the mitral valve. It occurs more frequently with mitral stenosis. This symptom is favored by the high tension in the pulmonary circulation, and is especially apt to follow upon embolism of branches of the pulmonary artery. Blood-spitting often gives marked relief. Infarctions are not incompatible with recovery, and may occur repeatedly in the same subject. Attacks of shortness of breath, attended by some pain in the chest and after a time cough, and sputum resembling the rusty expectoration of croupous pneumonia, suggest an infarction. The expectoration may continue for many weeks, presenting pigmented cells and crystals of hæmatoidin. To the congested pulmonary circulation and altered bloodvessels is largely due the œdema of the lungs which proves fatal in so many instances of chronic heart disease. Cohnheim's experiments suggest that the œdema is due to feebleness of the left heart, while the right remains capable, thus increasing the blood pressure in the pulmonary circuit. Œdema is attended by diffuse crepitation, bubbling râles, and the peculiar expectoration. It may be limited to the glottis, or both glottic and pulmonary œdema may be but part of a general dropsy. Pneumonic processes are common complications, and often fatal. Epistaxis may be present and attended by symptoms of cerebral congestion.

Stomach and Bowels. The appetite is poor and the digestive power feeble. Catarrh of the digestive tract is especially common in association with mitral disease. Flatulent dyspepsia often excites palpitation. The engorged mucous membrane may bleed. Hæmorrhoids are common. Sudden attacks of pain in the abdomen, followed by collapse, have been referred to as the result of embolism of the intestines or stomach. The liver is more frequently enlarged than the spleen. Complaints of tension, dragging, etc., in the right hypochondrium are frequent. The organ may be felt below the ribs with a smooth firm edge. Contraction may occur late. Congestion of the liver, and an accompanying catarrh of the bile ducts, are accountable for the icterus which is occasionally present.

Kidneys. The hyperæmic kidneys secrete a scanty, dark, heavy urine, which deposits urates. There may be albumin, casts, and symptoms of uræmic poisoning. With the development of interstitial hyperplasia the amount of urine will increase. Renal pain and bloody urine suggest embolism of the renal artery.

Nervous System. Nervous symptoms are common in cardiac disease, especially toward the close of life. They are associated oftener with aortic than with mitral lesions. Excessive blood pressure within the head is suggested by fulness, headache, dizziness, tinnitus and muscæ volitantes. Cerebral hæmorrhage occurs most frequently in association with aortic insufficiency, as a result of a high tension of the vessels during the heart's systole, and an atheromatous condition of the cerebral arteries. Right-sided hemiplegia with aphasia follows upon the plugging of the left middle cerebral artery. Aphasia may occur temporarily without an apparent lesion. Embolism has been referred to, the softening which follows forming one of the most important cerebral complications of heart disease. Syncopal attacks, dependent upon cerebral anæmia, are common to some cases, especially aortic stenosis, this lesion preventing the proper filling of the arteries. Headache, vertigo, loss of memory, etc., often appear with failure of compensation. Sleep is fitful and disturbed by dreams, or sleeplessness may prove an annoying symptom. Mental disturbances are often observed, varying in gravity from melancholia to maniacal attacks. There may be a suicidal tendency. Convulsions are rare, and, like other nervous symptoms, may be of uræmic origin. Epileptic paroxysms have been observed attendant upon embolic softening secondary to valvular disease.

Febrile Symptoms. Fever is not common in chronic valvular disease, its presence suggesting an intercurrent acute inflammation of the endocardium, or a complication of some nature, *e. g.*, pneumonia, pleuritis, bronchitis, etc. Such recurring inflammations are apt to be attended by symptoms of the embolic process. The relationship to the heart of a fever, occurring in a person who is the subject of a chronic

valve lesion, is often difficult to prove, time, and often an autopsy, being required to reveal its cause.

The Influence of Valvular Disease upon other Affections. The presence of a valvular lesion materially increases the gravity of complicating or coexisting diseases. This is especially true of the acute infectious fevers, and of inflammatory affections generally, particularly those which involve the lungs. The heart, under these circumstances, is incapable of satisfying the greatly increased demand which is made upon it.

Cardio-vascular sclerosis is very frequently associated with valvular disease, especially in middle or advanced life, and may involve the kidneys also. Pericarditis occurs most frequently in association with aortic disease, being favored by the thinness of the organ at this point. Nephritic complications may appear in any form, and present no especial peculiarities. Chorea is a frequent association, but not as common a complication as at one time supposed. It has been attributed to irritation of the pneumogastric nerve by the enlarged heart, also to embolism.

The preventive influence of valvular heart disease as regards phthisis, typhoid fever, etc., has been claimed, but has not been proven. Mitral lesions are especially unfavorable in their influence at the period of parturition. If the walls of the heart are degenerated, rupture may occur, or death may result from syncope soon after labor, as once happened in one of my patients with mitral disease, or the conditions of pregnancy and labor may excite intercurrent endocarditis.

Diagnosis.—It has been shown, in treating of the lesions of the several valves, that physical exploration is of the first importance in arriving at a diagnosis. Sufficient has been said upon this subject in that connection, and we will here consider only the general questions relating to the subject. First, if in doubt, the importance of repeated careful examinations under varying circumstances of time, position, exercise, etc., is insisted upon, and if a cardiac lesion is suspected, the necessity of avoiding the limiting of the observation to the heart region only. This is a common error. Much evidence of value may be secured from the pulse, and the condition of the arteries, brain, lungs, kidneys, liver, stomach, etc. The symptoms are not infrequently of such an indefinite character that attention may not be attracted to the heart, but if the rule is established of making physical examinations in every case of importance whether symptoms relating to the heart are present or not, fewer cases of cardiac valvular disease would be overlooked. The absence of a murmur in valvular disease is almost certain to derail the observation of the average examiner, yet this happens in many cases, especially after loss of compensation has taken place. A murmur may be absent in mitral regurgitation of rheumatic origin, and also in mitral obstruction, indeed, stenosis and regurgitation at the various orifices

have been met without the tell-tale murmur. Sometimes, after the giving way of the ventricle and the disappearance of the murmur, it may reappear after the use of digitalis or other cardiac stimulant. The fact that systolic murmurs are frequently inorganic, leads to the easier diagnosis of those lesions which give rise to diastolic murmurs. We are able to positively assert the organic origin of systolic murmurs therefore only when associated with changes in the cardiac wall, and even this is not always sufficient as a systolic murmur with dilatation may occur in emphysema, anæmia, febrile affections, etc. Functional murmurs are rarely accompanied by a thrill. As valvular heart trouble is often attended by albuminuria and the presence of casts in the urine, and as nephritis may have associated heart lesions attended by a murmur, it is often difficult to solve the problem as to whether the cardiac or the renal affection is the primary disease, a question that frequently arises for the first time upon the appearance of general anasarca. In Bright's disease the dropsy usually appears first about the eyes, with subsequent involvement of the ankles and extension to the trunk. The external genitals are usually much swollen, and later, the serous cavities may be involved. The dropsy and albuminaria of heart disease may often, and repeatedly in the same case, be greatly lessened or entirely disappear. The inorganic systolic murmurs (inorganic murmurs are never diastolic) may be looked upon as indications of valvular lesions if insufficient attention is paid to the "setting," especially to the condition of the heart walls, the circulation, and to the more important organs. This error is the easier commited as anæmia with marked reduction of blood corpuscles and of hæmoglobin is an occasional attendant upon both aortic and mitral disease. The harsher character and well-defined extensions of organic murmurs will also assist. The intensity and character of a murmur is not indicative of the gravity of the valve lesion, although loud murmurs rather suggest a slight lesion and a still strong action of the heart, while with its enfeeblement, the murmur grows fainter and may finally disappear. In young subjects the heart lesion is usually of rheumatic origin, with little or no change in the arteries, but later in life, the influence of bad habits of eating, drinking, exercise, etc., appears. The lesion is then usually sclerotic, and coincident sclerotic changes may be detected in other portions of the vascular system.

In physical examination of the heart, attention should be paid to all the valves, as more than one may be diseased. This can be determined by attention to the foci of greatest intensity, and to differences in quality, pitch, and extensions.

Prognosis.—The changes occurring in the valves are usually incurable, but, if of inflammatory origin and detected early, some degree of success may be attained in their treatment, at least the lesion may often

be limited, and the future of the organ correspondingly conserved. The significance of an alteration in the structure of a valve depends largely upon the resulting changes in the walls of the heart. The intensity and character of the attending murmur has been stated to possess little prognostic weight, except that loud murmurs are more apt to attend if the heart is still strong, and weakening with its debility. After localization of the lesion the most important step is to determine what extent of dilatation of the heart, if any, has resulted, and the degree of venous stasis attendant upon the same. Valvular lesions become a menace to life, if we leave out certain unusual results, such as embolism, only when dilatation of the cavities is greater than the compensatory hypertrophy. Some patients succumb to the primary or early dilatation which follows so promptly upon grave lesions, but more, from the dilatation which follows from failure of compensation. It may be stated in a general way that diastolic murmurs are of more serious import. Aortic diastolic, and mitral diastolic (so called presystolic) murmurs are especially grave. Aortic regurgitation is the form which most frequently results in sudden death, although sudden death is not common in valvular disease. Systolic murmurs are frequently inorganic. An aortic systolic murmur of organic origin is the least important of systolic organic murmurs. Right-sided murmurs, with the exception of the pulmonic direct, are attended by danger. The mitral systolic murmur of regurgitation may exist in some cases indefinitely without impairment of the health. The general health, habits, etc., of the individuals suffering from a valvular lesion possess a strong influence over the continuation of compensation. Improper exercise, labor, eating and drinking, are prejudicial. The tendency of acute disease to set up degenerative changes in the cardiac walls, and thus to favor dilatation, also the influence of pulmonary lesions in overtaxing the right ventricle, should be remembered. In common with other observers I have repeatedly noted the disappearance of murmurs and other evidences of valvular disease. In each instance my patient has been young, and all but one, which developed during diphtheria, were of rheumatic origin; in one case the murmur continued nearly one year after recovery from the acute disease. The lesion was mitral incompetency and there was an absence of anæmia.

Treatment.—If annoying symptoms are present the patient should, in most instances, be made aware of the nature of his disease, in order to secure more intelligent co-operation in its treatment. There is too great a tendency to medicate patients suffering from valvular disease of the heart, but medicinal agents should be employed only for the control of such symptoms as may be unrelieved by careful employment of physiological methods. This statement applies as well to the practitioner who employs the homœopathic method, as to the "regular" with his tincture of digitalis. Too much dependence upon drugs leads to neglect of a

regulation of the general habits, as the ease with which the symptoms may be at times relieved by medicines is a temptation to the neglect of methods which give much better ultimate results. Unfortunately the adoption of a rigid plan of treatment is too often neglected until demanded by failing circulation. Of the various general features of treatment, rest is perhaps the most important one, as the heart affected with valvular lesions is generally a weak organ, at least in the cases of valvular disease the physician meets; the heart is usually defective in strength and it is the symptoms growing out of such failure that generally lead to a consultation with a physician. In considering rest, not only should the question as to whether the patient is undergoing too great physical or mental exertion be considered, but the influence of worry, and even of pleasurable excitement, must be estimated. It may be stated as an axiom that the patient suffering from valvular heart disease must bring down the level of his life activities to that of his heart's capability. As these patients need more than the normal quantity of oxygen, it must be so arranged that they shall not be confined too much within doors. In the securing of proper rest, too much confinement to the house is often entailed. The degree of rest to be secured, and the precise method adopted to secure this end, can only be determined by careful consideration of the heart's condition, as well as of the general state of the individual. With the evidences of beginning dilatation, and later, with rapid loss of compensatory power, I have repeatedly secured a prompt arrest of the process and a reduction in the size of the organ, also a disappearance of the evidences of venous stasis, by means of rigid rest in bed for a few weeks, coupled with skilful massage to assist the venous circulation, a reduction in the intravascular pressure by means of a dry diet, and the administration of concentrated nutritious food selected after careful consideration of stomachic, diathetic, and other governing conditions. Tobacco and alcohol should be prohibited, unless the latter is demanded as a medicine. Change of residence often exercises a favorable influence. Moderate altitudes are best. A residence at the seashore often increases the subjective symptoms. A warm climate is advisable in winter, as it enables the patient to live out of doors, secures better oxygenation of the blood, and lessens coexisting bronchitis. Dyspeptic symptoms must receive careful attention, the bowels should be kept regular, and straining at stool avoided. The Oertel plan of systematized exercise upon ascending planes proves valuable in some cases. This method must be carefully supervised or the heart may be overtaxed. During the period of apparently perfect compensation it will seldom be necessary to prescribe medicines, but occasionally symptoms of heart irritability will suggest the use of *aconite, veratrum viride, ignatia,* or *valerianate of ammonia,* etc., in the lower dilutions. Remedies which exercise a depressing influence upon the heart should always be prescribed with care.

The most important evidences of failing compensation are, dilatation of the heart with overfulness of the venous system, a weakening pulse, some form of arrhythmia, and dropsical symptoms.

Whether it is ever best, in common with our old school colleagues, to treat cases by means of depletory measures, such as saline purges and venesection, each must judge for himself. I have never employed venesection for this purpose, but cases presenting cyanosis, orthopnœa and imminent danger of death, suggest the employment of these measures when others fail. As physiological whips in this condition, *digitalis*, *strophanthus*, *caffeine* and *strychnine* occupy the most prominent positions. The first named is in much the greatest repute. Failing compensation is the indication, a feeble irregular pulse a prominent symptom. The valve involved is not important. I have rarely given the doses of five to fifteen minims of the tincture which are commonly prescribed and repeated every few hours. Rest, with the administration of five drops of the first decimal dilution every one-half to three or four hours, will very often succeed. One should be exceedingly careful not to "slow" the rapid, feeble heart quickly by means of digitalis or any other agent. A gradual result is safer. When sharply indicated, even much smaller doses will often suffice. The favorable influence of digitalis in failing compensation, when given in moderate doses of the tincture, is so positive that only a lack of experience or prejudice can generate opposition to its use. As in the case of all valuable medicines, it is greatly abused, bad results arising largely from unwise increase of dose to meet cases not relieved by the ordinary quantities prescribed. If improvement does not follow upon the use of five-drop doses of the tincture, repeated several times daily, I am disposed to select another agent. The general adaptability of digitalis to the condition under consideration has led many old school authorities to speak disparagingly of medicines less frequently useful for the same condition. *Convallaria* belongs to this class. Its sphere is narrower, but within it, results are as favorable as from digitalis. It appears to be most applicable to the feeble right heart which results from obstructive pulmonary disease. If dropsy has developed, it is diminished in proportion to the improvement in the heart's power. If the case is a nervous woman, with great mental irritability, convallaria is the better indicated. Hale prefers a tincture of the fresh flowers. Pepper states that "strophanthus in the form of a tincture, of which three to eight minims may be given every three or four hours, sometimes proves reliable, but oftener unreliable. Adonidine and convallaria have been lauded as remedies equalling digitalis, but their reliability may be seriously questioned." The question of special adaptability to certain, even unusual cases, is not raised.

Strophanthus, in my own experience, has been specially useful in the failing heart of cardio-vascular sclerosis. These cases are usually asso-

ciated with an interstitial nephritis. In valvular affections, with an excess of pale urine, it has sometimes appeared to modify favorably the entire symptom group, even in the lower dilutions. As a cardiac whip it is undoubtedly less frequently useful than digitalis. For this purpose doses of from two to four minims of the tincture may be necessary.

As to *adonis*, or its active principle *adonidine*, little can be said, as our experience is yet small and the indications furnished are not sufficiently characteristic. A prominence of dropsy has been thought to be an important indication. *Adonidine* and *erythrophyleum* have been of benefit in the asthma attendant upon cardiac disease. *Caffeine* has of late come to the front as a remedy in urgent cases of cardiac failure, and is often given hypodermatically. Dujardin-Beaumetz commends it extravagantly. For hypodermic use a solution of a drachm each of *caffeine* and *salicylate of sodium*, in two drachms of distilled water, is very satisfactory. Ten to fifteen minims may be injected as required. Recently, in a case of aortic disease in an old man, rapid heart failure induced by an attack of pneumonia was promptly relieved by ten minim injections. *Nitro-glycerin* is pre-eminently indicated if with failing heart there is high arterial tension. It follows, therefore, that this medicine will be given more frequently in aortic disease. It is often combined with digitalis. From one-quarter to one drop of a one per cent. solution may be repeated every one to three hours, according to the necessities of the case. Experience favors the giving of small and frequently repeated doses. *Sulphate of sparteine* I have used with great satisfaction, and while it frequently fails, its favorable action has repeatedly impressed me. It is generally sufficient if given in grain doses of the first decimal trituration. Doses as large as a quarter of a grain may be repeated every few hours. In several cases marked by cardiac weakness and disturbance of rhythm, but without murmurs or evidence of mural disease, its beneficial action was conspicuous. The presence of a nervous or hysterical element suggests sparteine. In the case of a lady who had such a period of heart feebleness that she was finally confined to bed five months, but without evidence of valvular or mural disease, relief from sparteine was prompt. The condition was, undoubtedly, largely hysterical.

Agaricine. The writer's observations, appearing in the *Hahnemannian Monthly* at different times during the past few years, represent all that has been published upon agaricine as a cardiac stimulant. Considerable experience has now been accumulated, sufficient indeed to place this remedy in the front rank of medicines of this class. Its range is more limited than that of digitalis. In two or three cases of extreme dilatation of the right heart, secondary to mitral disease or emphysema of the lungs, digitalis and other well-known stimulants having failed, and a fatal result appearing imminent, two or three grain doses of the first decimal trituration of agaricine, repeated every one to three hours, gave

not only temporary relief, but in two instances protracted the patients' lives and conferred much comfort. As a remedy in cardioplegia it can hardly be excelled, not even by strychnine. The indication which first led to the use of agaricine in these cases was troublesome coexisting sweating.

Strychnine. This remedy is undoubtedly a valuable heart as well as general tonic, but is suffering the usual abuse meted out to popular remedies, namely, indiscriminate use and enormous dosage. It is usually administered in cardiac dilatation at a later period than digitalis, *i. e.*, after the latter medicine has relieved the urgent symptoms. Doses of one-hundreth to one-twentieth of a grain are recommended. It is a question as to whether doses larger than one-sixtieth of a grain should ever be administered. Under the same circumstances *arsenic* may often prove preferable to strychnine. It presents a large array of symptoms suggesting it. The *iodide of arsenic* has seemed to me preferable. Both of these medicines may act favorably in very small doses, but the free use of the second decimal trituration has given the best results. If dropsical symptoms prove uncontrollable by ordinary means it may become necessary to use the infusions of *digitalis* or *apocynum can.* (two drachms to the pint of water) beginning with half teaspoonful doses and increasing until a satisfactory effect is secured. Rapid action is not usually desirable. It must be remembered that the tinctures of these plants possess but feeble diuretic power. Unpleasant action usually appears in the form of gastric irritability, but this may generally be avoided by beginning with small doses well diluted, and if necessary administering them by the rectum. Should diuretics fail, capillary drainage may be employed. This is accomplished by inserting into the œdematous tissues a small perforated needle to which is attached a piece of fine rubber tubing for the purpose of conveying the fluid to a proper receptacle. The needle should be fixed in position by means of adhesive plaster or bandages and left for a number of hours. After the pressure is relieved in this manner it is not uncommon for remedies which had previously given no result to act favorably. Purging may be considered in some cases, good results being often obtained if venous stasis is extreme.

Treatment of Special Symptoms, and Conditions Associated with Valvular Disease of the Heart.—Anæmia. The anæmia which is so frequently a prominent attendant upon valvular disease is best treated by rest, careful feeding, and in some cases by massage and general faradization. *Iron* in some form is a most useful remedy. The lower triturations of the *iodide* or the *arseniate* of *iron*, I have found most efficient. These remedies also exercise a favorable influence over the heart lesion. The trituration of the iodide employed should be fresh. The preparation of blood recommended by Prof. O'Connor of New York, I have found useful, giving about sixty grains daily in cachets. Flint's chalybeate pill, which is based upon the composition of the blood, is also

very useful. If the anæmia is obstinate and of high grade, *arsenic* is the most useful of remedies, and symptomatic indications for it are often present. While small doses often succeed, the second trituration in doses of three grains several times daily gives more uniform results.

Disturbances of Respiration. A careful search for the causes of dyspnœa should always be made, as the symptom is dependent upon a variety of influences. Several may act at the same time. It may be due to collections of fluid in the pleural sacs, which are especially apt to be overlooked if not associated with general dropsy. This is particularly the case when dependent upon mitral disease, and may demand repeated paracentesis. Most frequently it is due to stasis in the pulmonary circulation and can only be relieved by improvement of the heart's power. Chronic bronchitis often adds much to the patient's distress. If unable to lie down at night the most comfortable support possible should be contrived for the patient.

Inhalations of oxygen are often helpful, and bronchitic cases with profuse expectoration, especially if pulmonary phthisis exists, are benefited by inhalations of *creasote.* The *arsenite of antimony,* in the second decimal trituration, is a useful medicine under these circumstances. Valuable for the bronchitis, but less effectual for the dyspnœa, is *stannum iodide* in the same dose.

Local Symptoms. With the presence of marked hypertrophy there may be symptoms growing out of excited action of the heart. According to the indications these are met by *aconite, belladonna, cactus, lilium tigr., verat. viride,* etc. Cold to the præcordium may be used in the form of an ice bag. Very hot fomentations persistently employed relieve pain, and appear in some cases to at least temporarily improve the heart. Opiates must be rarely necessary, as *aconite, cactus, spigelia, bryonia* and *scilitin* in the second decimal dilution are very efficient remedies for the acute pain.

Gastro-intestinal Symptoms. With the development of marked disturbance of the digestive tract, there is usually serious stasis in all of the abdominal organs, and little improvement is to be hoped for. Nausea and vomiting may be frequent, digestion feeble, and large amounts of gas developed which may by its upward pressure excite palpitation and oppression of breathing. Little can be done directly for these organs beyond careful regulation of diet, which should be nutritious, small in quantity, and non-flatulent in character. A few grains of *subgallate* of *bismuth* after food, as suggested by Professor Flint, is often invaluable for the flatulency. I have obtained equally good results from *naphthalin,* first decimal trit., grains five, every few hours. Lavage is to be strongly commended for many of these cases, particularly if there is a good deal of gastric catarrh or dilatation of the stomach. A saline cathartic, by reason of its unloading effect upon the abdominal circulation, often accomplishes

more for the patient than any other means. For the milder cases *ipec.*, *nux vom.*, *iris v.* are often useful, but for cases in which gastric catarrh has developed, *argentum nitr.*, *arsenic*, and *creasote* are more efficient.

Symptoms Referable to the Kidneys. Late in valvular disease the urinary secretion becomes scanty, is often albuminous, and may contain casts. Under these circumstances uræmic symptoms may appear. It is a most unpromising condition and may determine a fatal issue. It is best to confine the patient to a warm bed, to give non-nitrogenous liquid food, and if necessary, to make use of increased activity of skin or a purge. These measures, in addition to whatever medicines are indicated, often postpone, for a time, a fatal result.

DISEASES OF THE HEART SUBSTANCE.

HYPERTROPHY AND DILATATION OF THE HEART.

Enlargement of the heart may result from an increase in the volume of its muscular fibres, or from an enlargement of its cavities by dilatation. These conditions usually coexist. Both may attack one or all of the heart's chambers. Confusion in their description is best avoided by considering them separately. Hypertrophy is, in most instances, a conservative process, while dilatation is the heart's greatest enemy, indicating, as it does, incompetency to meet the demands made upon it.

CARDIAC HYPERTROPHY.

Two forms of hypertrophy are clearly distinguishable. First, *simple hypertrophy; i. e.*, thickening of the cardiac walls, the cavities being unchanged in capacity; and, secondly, *hypertrophy with dilatation; i. e.*, thickening of the heart's walls with coexisting enlargement of the cavities. The form at one time designated concentric hypertrophy, in which with thickening of the walls the heart chambers were diminished in size, can be ignored, the reduction in size of the cavities now being attributed to post-mortem changes.

Hypertrophic changes in the heart are usually limited to the walls of one or more of the cavities. The ventricles are more frequently involved than are the auricles; the left more often than the right heart. Occasionally the entire organ is involved, but the progress of development is usually a gradual one, the changes commencing in the muscular structure of the walls of one cavity and extending consecutively from this to the others, for reasons which will appear presently.

Etiology.—Hypertrophy of muscular tissue occurs when increased demands are made upon the heart, while its tissues are still well nourished. This demand will be fully met physiologically until the nutritive supply is diminished in quantity or becomes abnormal in quality, or both; then degeneration and dilatation result. The most frequent demand for increased work on the part of the heart undoubtedly follows upon the establishment of obstructive valvular diseases of that organ; the blood current being obstructed by a constricted condition of one or

more of the ostia. Incompetency of the valves is also followed by the same result ultimately. The walls of one chamber are first involved. The hypertrophy is not infrequently preceded by dilatation, especially if the obstruction to the circulation has been rapidly developed, the heart muscle giving way before the increased resistance, insufficient time for hypertrophy to take place having elapsed. This early dilatation is in itself a cause of hypertrophy. Of less importance than obstruction within the organ itself are lesions of the larger arteries, such as aneurismal dilatation, arterio-sclerosis, constriction, and increased resistance in the peripheral vessels. The last is exemplified by the hypertrophy of the left ventricle consecutive to Bright's disease of the kidneys, or by hypertrophy of the right ventricle following upon left heart disease or pulmonary affections obliterating pulmonary capillaries.

Long-continued functional activity, as induced by laborious occupations, imprudent athletic exercises, palpitation, excessive drinking of fluids, such as beer, and particularly, the overactivity incident to exophthalmic goitre, have been shown to excite hypertrophy of the heart. Pericarditis, through resulting adhesions, may obstruct the free action of the heart and induce hypertrophy. A so to speak physiological hypertrophy occurs during pregnancy, but restoration of the heart muscle to the normal takes place after delivery. A form in which the cause is not apparent has been designated *idiopathic hypertrophy.* It is usually associated with dilatation. Many of these idiopathic hypertrophies are supposed to be due to an aorta of insufficient calibre, the condition being congenital, or to excessive exertion, palpitation, excesses in food and drink, sexual excesses, plethora, etc. But often there is nothing apparent to show why the heart changes should exist. The term "idiopathic" has also been used to designate hypertrophies arising from other causes than valvular lesions.

Morbid Anatomy.—The increase of the heart muscle is due to a development of new fibres (numerical hypertrophy). This must be true, as the individual elements are not increased in size. The connective tissue elements are increased in individual cases, thus leading Quain to designate such as false hypertrophy. In true hypertrophy of the heart the cardiac muscle is stiffened, manifests increased resistance (this is especially true of the right ventricle), and is abnormally red in color. The papillary muscles are thickened in eccentric hypertrophy. The septum is little affected in simple hypertrophy. In the eccentric variety it becomes thickened.

The hypertrophied heart is increased in size and weight. The normal male heart weighs about nine ounces; the female heart about one ounce less. The increase may be as great as thirty or forty, or even more, ounces; for there seems to be almost no limit to the size which the heart may attain. Alonzo Clark's case, in which the heart weighed

fifty-seven ounces, is thus far the largest on record. It is unusual to observe a case in which the heart weighs more than twenty to twenty-five ounces, the size of the organ is therefore not infrequently more than doubled, and its shape much changed. The contour will depend largely upon the extent and location of the hypertrophy. If general, the shape is that of an obtuse-angled triangle. If the left heart only is involved, the organ is elongated, extended to the left, and conical. In case of hypertrophy of the right heart, the enlargement is to the right, the shape broad and spherical; with marked hypertrophy of both ventricles, the apex loses its conical shape, becoming broader and blunted. In great hypertrophy of the right ventricle, the left ventricle is removed from the chest wall, the apex being represented mainly by the right ventricle.

The degree of hypertrophy may be well judged of by the thickness of the heart's walls. The left ventricle, which is normally rather more than four lines in thickness, may increase to even four or five times that. The right ventricle, which normally measures about two lines, may increase to from four to ten lines. The auricles, which have a normal thickness of about one line, may double that thickness. The left auricle at times attains the thickness of three or four lines.

Considering in detail the causes of hypertrophy of the walls of the several cavities, it may be stated that left ventricle hypertrophy follows in its most characteristic form upon aortic disease, the enlargement sometimes being enormous. Next in frequency as a cause is mitral leakage. Uncommon influences are pericarditis with adhesions, and myocarditis of sclerotic variety, also diseases, drugs, exercises, etc., acting through the nervous apparatus of the organ. These etiological factors, it will be observed, exert their influence directly upon the heart. Others act indirectly through the bloodvessels, the most important of these latter causes being increased blood-pressure due to the circulation of irritants in the blood. These excite contraction of the smaller arteries, increasing correspondingly the vascular tension, and developing arterio-sclerotic degeneration. This condition is frequently associated with kidney disease. The small aorta pointed out by Virchow is capable of exciting overaction and hypertrophy of the left ventricle.

Hypertrophy of the left auricle is the result of insufficiency of the mitral valve, or of stenosis of the ostium. It is invariably associated with dilatation. This dilatation and hypertrophy is true also of the right *auricle*, which enlarges secondarily to left heart disease or obstruction within the pulmonary circuit. Tricuspid stenosis is a rare cause.

The right ventricle hypertrophies from any cause which increases pressure in the pulmonary artery. This necessarily results, if its radicles are obliterated by changes in the pulmonary tissues, as in interstitial pneumonia, emphysema, etc. Mitral disease exercises a similar influence, and

is a more frequent cause. Valvular lesions upon the right side are an infrequent cause in adults. Congenital hypertrophy may result from valve lesions originating in fœtal life.

Symptomatology.—The symptoms of hypertrophy of the heart cannot be separated from those of the lesions which accompany it. Its development is restorative or conservative in its effect, and consequently diminishes existing symptoms or prevents their development. Nature in this manner often establishes so perfect a compensation that long periods of time may pass without the development of annoying symptoms, indeed, without sufficient symptoms to call attention to the existence of any disease of the heart. In general there is sufficient sense of præcordial discomfort to call attention to the heart as not being normal. Sensations of tightness or oppression, perhaps a positive shortness of breath, may exist. Palpitation is often only objective in character, the patient not infrequently being astonishingly unconscious of its existence. The pulse is full, large, strong, and remarkably sustained. Hayden lays great stress upon these qualities. This author also states that the pulse is less strong, fuller, and relatively better sustained if dilatation predominates over the hypertrophy. Should the hypertrophy be limited almost entirely to the right ventricle the pulse may be feeble and disturbed in rhythm.

A variety of head symptoms may result from the circulatory disturbance, viz., congestive headaches, cerebral hæmorrhages, and symptoms of irritation of the optic and auditory nerves.

The common coexistence of sclerotic changes in the arteries leads to the development of certain associate groups of symptoms. Those incident to cerebral hæmorrhage have been referred to, this accident being the result of the action of the powerful heart upon sclerotic sacculated arteries within the brain. Similar hæmorrhages may occur in other parts. While hypertrophy of the heart is contributory to vascular degeneration and its sequences, it is not the cause, as stated by Osler.

Physical Signs.—The physical evidences of hypertrophied heart will vary according to the extent of the lesion, the portion of the organ involved, and the degree of dilatation which coexists. Upon *inspection* and *palpation* a bulging of the præcordia may be discovered. This sign is not prominent unless the hypertrophy occurred while the costal cartilages were still flexible. In young subjects it may give rise to marked distortion of the chest wall. It is usually associated with pericardial adhesions. The apex beat is abnormally forcible and extended, and is displaced to the left and downward in proportion to the degree of hypertrophy. The more outward, the more the enlargement predominates in the right ventricle, and the more downward, the greater the hypertrophy of the left ventricle. It may be felt even several inches beyond the nipple line and as low as the ninth interspace. The intercostal spaces may be conspicuously broadened and more distended than normal. A strong,

heaving, slow impulse is generally present. The head of the auscultator may even be lifted forcibly by the strong impulse. The region over which the pulsation is the most marked depends upon the nature of the case. In left-sided hypertrophy, it is to the left and downward; in right-sided hypertrophy, it is especially to the right and in the epigastrium. Associated dilatation shortens the impulse.

On *percussion* both the superficial and deep areas are found to be increased, mainly downward, and to the left or right, according to the ventricle most enlarged. Dulness is seldom much extended to the right, however, and not often increased upward. Extension in the latter direction is suggestive of dilatation of the auricles, as it is developed only when dilatation is conjoined with hypertrophy. The transverse line of dulness may vary from the normal up to seven or more inches. A transverse dulness of about four inches represents the average extent in hypertrophy. The oval shape of the dull area is retained.

On *auscultation* in uncomplicated hypertrophy the first sound may be but little changed. But if the lesion is well marked it becomes abnormally powerful, prolonged and dull. There is shortening of the post-systolic silence; a metallic quality is not unusual. The area over which the heart's sounds are audible is increased. As dilatation is gradually added the first sound loses its prolonged muscular quality, becoming shorter and sharper in its evolution. The presence of valvular lesions modifies these characteristics.

In the case of hypertrophy of the left ventricle the aortic diastolic sound is intensified; if the hypertrophy is general both elements of the second sound are more marked.

A whizzing sound may be produced in the arteries by pressure. Should emphysema of the lungs be present the cardiac sounds are more or less obscured and the area of cardiac dulness diminished. The same results if the lung is fixed by adhesion and cannot be displaced by the enlarged heart.

Diagnosis.—The diagnosis of hypertrophy of the heart is not attended by much difficulty. In the eccentric form, hypertrophy exhibits points of similarity with pericardial effusions, aneurism of the aorta, tumors of the mediastinum, consolidation of the lung, sacculated pleural effusion, etc. When a hypertrophied and dilated heart is associated with a quantity of fluid in the pericardium the diagnosis is attended by the greatest uncertainty.

The cardiac excitement found in neurotic individuals at times may lead to error. But with sufficient attention to the character of the impulse, and the repeated examination of the patient under varying circumstances, a diagnosis can be made. It is well to remember that hypertrophy may arise from long-continued overaction of the heart, as witnessed in neurasthenics, tobacco users, Graves' disease, etc. Otherwise

one may be unduly influenced by the nervous character of the patient and overlook an actual hypertrophy.

Retraction of the lung may increase the area of cardiac dulness and suggest cardiac enlargement.

Prognosis.—Hypertrophy *per se* cannot be looked upon unfavorably, being in nearly all instances compensatory in character. Slight uncomplicated hypertrophies resulting from overexertion, certain slight valvular lesions, or obstructive lesions which have been removed, or those due to neurotic influences, or to an acute or subacute Bright's disease which has been removed, are hardly to be looked upon as serious and do not disturb health or curtail life. The prognosis is much less favorable in hypertrophy of the right ventricle, on account of the attending obstruction in the pulmonary circuit. The periods of special risk are first, *early*, when an early dilatation is not followed by a degree of strengthening of the heart muscle sufficient to overcome the obstruction. In such cases death may occur early. Secondly, *late, with failing nutrition*, due to degeneration of the cardiac muscle and a failure of compensation. In every case a comprehensive view of the illness must be taken in framing the prognosis.

Treatment.—As the causes of hypertrophy are usually irremediable it follows that the compensatory change in the heart should not be interfered with, as its influence is salutary only. It is best to warn patients to avoid all influences calculated to excite the action of the heart, *i. e.*, undue exercise, mental excitement, excessive or improper eating and alcoholics. It is wise to make the diet as dry as may be consistent with other conditions of health, and thus reduce intracardiac resistance. All influences which in any manner interfere with the circulation of the blood must be avoided. The bowels must be kept open and straining at stool avoided. The digestive functions must be watched, as proper nutrition is essential to the prevention of degeneration in the thickened cardiac muscle, and consequent loss of compensation. Flatulency also disturbs the heart's action. With excessive hypertrophy and an irritable heart, symptoms of hyperæmia, especially of the brain, may arise. Bleeding and other depurative measures of treatment, at one time adopted under these circumstances, are unnecessary and harmful, disposing to anæmia, a condition to be avoided with the utmost care in these cases. In general it will be found best to give nitrogenous food freely and to lessen the quantity of carbohydrates taken.

Medicines are of service in relieving annoying symptoms, and consequently in some degree control the progress of the disease. *Aconite* for the congestive symptoms, is much lauded even by the old school, but it is unwise to administer it in large doses. The lower dilutions are sufficient for suitable cases. *Cactus* and *lilium tigrinum* are often indicated and prove of great clinical value in my hands. *Belladonna* may

help especially in young subjects, and *glonoin* follows well if belladonna does not relieve. Russell recommends *naja* highly. Madden and Bayes claim curative influence from *arnica*, when the hypertrophy is due to violent exercise and independent of a detectable lesion. *Rhus* also is useful in cardiac hypertrophy dependent upon overexertion and without valvular disease. *Bromine* is recommended for the same condition by some authorities. *Rhus* seems to be especially applicable when the trouble arises thus in rheumatic individuals. In the *bromine* case there is considerable oppression about the heart; palpitation comes on after the slightest exertion, even rising from a sitting to a standing posture. *Aurum* is suited to cases in which the action of the heart is strong, as a result of which there occur congestions of different viscera. The *chloride of gold and sodium* may be preferable to the aurum metallicum. *Arsenicum* has been recommended for the cardiac hypertrophy resulting from such exertion as excessive climbing. *Sepia* is occasionally of service, particularly in women.

Kalmia latifolia, *lachesis*, *lycopus*, *nux vomica*, *digitalis*, *spigelia*, *coca*, *veratrum viride*, *sulphur*, *calcarea carb.*, and *cuprum* have all groups of symptoms and clinical experience to commend them in this affection. *Coffea*, *caffeine*, and *chamomilla* sometimes meet the palpitation which is partly of nervous origin. For the treatment of symptoms appearing with failure of compensation, the reader is referred to the chapter on dilatation of the heart.

DILATATION OF THE HEART.

Dilatation of the heart is represented by an increase in capacity of one or more of the heart chambers without a proportionate increase in the walls. Several forms of dilatation may be recognized:

I. *Simple dilatation*, in which the walls of the heart remain of about their normal thickness.

II. *Dilatation with hypertrophy*, which is the most common form.

III. *Dilatation with thinning* of the heart's walls.

Cases may be observed in which all these different forms are present at the same time in different portions of the heart.

Etiology and Morbid Anatomy.—Dilatation of the heart is substantially the result of a demand upon that organ which it is unable to meet, either as the result of great rapidity of development of the causative agency, the heart being unable to hypertrophy rapidly enough to overcome the obstruction; or, as the result of impaired nutrition after hypertrophy has taken place. The essential features then in the production of cardiac dilatation are (1) increased blood pressure, and (2) defective resistance on the part of the cardiac walls.

Abnormal blood pressure. When speaking of hypertrophy of the heart, the various conditions which excite an increase in the intra-cardiac

blood tension were quite fully detailed, and therefore need not be repeated here. In addition to obstructive lesions situated at different points within the circuit, we may mention the influence of certain affections which lead to weakening of the heart's walls and strongly favor dilatation, *i. e.*, endo- and pericarditis, and the various inflammatory and degenerative lesions of the myocardium. Dilatation is observed sometimes as a result of the acute infectious diseases, especially typhoid fever, typhus, rheumatic fever, erysipelas, pyæmia and post-scarlatinal nephritis. It is not rarely associated with the various anæmias. Excessive sudden exertion, especially in elderly degenerating individuals, is not an unusual cause. Dilatation has also been credited to certain nervous conditions, the excessive use of tobacco, etc.

The walls of the cavities which are normally the least able to bear strain will most frequently be found dilated. The right ventricle is therefore oftener affected than the left, and the attenuated walls of the auricles more often than either ventricle. In aortic valve incompetency, the return flow at the beginning of the heart's diastole, added to the normal amount received from the left auricle, distends the ventricle. A direct relationship exists between the degree of dilatation and the amount of regurgitation.

Mitral incompetency results in overfilling of the left auricle, which dilates, increased pressure throughout the pulmonary circuit and consequent dilatation of the right ventricle. Stokes contended for dilatation of the right ventricle in association with many affections of the abdominal organs. Fortunately, regardless of the cause, hypertrophic changes are soon set up, compensation is established, and the otherwise inevitable circulatory disturbances are averted.

Dilatation but rarely occurs independently of hypertrophy. Two or more cavities are generally involved. The shape of the organ is abnormal, due to especial prominence of the dilated portion. The ventricular walls are usually thinnest near the apex. The auricles may be so attenuated that at points only the serous membranes apparently remain. The muscular tissue is brittle, pale, and, upon examination with the microscope, shows the various evidences of fatty degeneration. Fatty areas may be visible to the naked eye.

Symptoms.—The symptomatology attendant upon dilatation of the heart will depend very largely upon the portion of the organ involved, as well as upon the degree of distention. The amount of dilatation matters but little if the accompanying hypertrophy is sufficient to compensate for the loss in power resulting from the thinning and stretching of the cardiac walls. If compensation is not thus maintained, symptoms arise which are in the main those of weak heart. Considering only the uncompensated form of dilatation, it is not possible to readily separate the symptoms of dilatation from those of the cardiac lesion.

Palpitation is probably the symptom most frequently complained of in all forms of dilatation. If it has already existed during the continuance of compensation, it becomes more troublesome after the break has occurred. It is evidently excited mainly by the endeavor of the heart to make up in frequency what it lacks in power. When dilatation precedes hypertrophy, palpitation diminishes as the latter condition is becoming established, entirely disappearing with full compensation. This symptom often becomes distressing. It may be associated with sensations of oppression, weight, and throbbing in the region of the heart. It is often attended by dyspnœa, which may be paroxysmally aggravated, especially upon exertion and excitement. Marked arrhythmia attends advanced dilatation.

Dyspnœa, especially upon exertion, which is due essentially to stasis in the pulmonary vessels, becomes a prominent symptom; the patient being unable to ascend stairs or walk much upon the level without the respiration being increased in frequency and attended by difficulty. It is often increased at night, forcing the patient to the sitting posture or compelling him to get out of bed. Sleep is constantly much disturbed. Obstruction in the systemic circulation is responsible for the cold extremities, cyanotic appearance, sleepless nights, troublesome dreams, mental failure, and disorders of the digestive and other organs. The pulse becomes irregular and intermitting. The urine is often albuminous, and may contain blood. Bronchitis, with annoying cough and expectoration, is common. Pulmonary infarctions, pulmonary œdema, and effusion into the pleural sacs are less common conditions.

Dropsy is a certain result of a marked degree of cardiac failure. It begins in the lower extremities and extends gradually to the genitals, face and back, and still later may involve the various serous cavities.

Congestion of internal organs may occur, and gives rise to many symptoms. Affecting the brain it causes the somnolent, apathetic condition often present late in the course of the disease, nocturnal wandering, and unpleasant dreams.

The liver often becomes involved. The cardiac dilatation leads to enlargement of this organ, with some degree of pain. Occasionally there is well-marked pulsation in this locality, if there is free tricuspid regurgitation. A catarrh of the hepatic ducts may cause an icteric color of the skin.

The kidneys show disturbance, manifested by high-colored urine, which is scanty, depositing large quantities of urates; as already stated, albumin may be present even in large quantities.

Physical Signs.—Inspection. A diffusion of the area of cardiac impulse with, usually, inability to locate the apex beat by inspection, is the most important perceptible sign. The apex beat is displaced. If the right heart is largely dilated, the left ventricle is displaced from

the chest wall, the apex beat of which then becomes invisible, and a diffuse pulsation is seen to the right and below the ensiform cartilage, and in the interspaces to the left of the sternum. It is improbable that pulsations are excited by the dilated left auricle. They are observed, however, over the right auricle, *i. e.*, in the third right interspace, near the sternum. Should the chest walls be padded with much fat, but little can be learned by inspection, the impulse of the heart being neither seen nor felt. In thin-walled chests, the entire præcordial region may manifest an undulatory motion. Pulsations in the epigastrium suggest that the right ventricle is involved. Pulsation of the jugular veins may be present in right-sided dilatation with regurgitation through the tricuspid valve.

Palpation confirms what has been learned upon inspection. But even palpation often fails to locate the apex beat more accurately. Then it becomes necessary to resort to auscultation. The feebleness of the heart's action, and the diffusion of its impulse can then be readily discovered. Occasionally a thrill may be observed.

Percussion. The area of dulness is enlarged in proportion to the degree of dilatation, and presents a squarish outline. The lateral line of dulness may be greatly increased. The extension is downward and to the left, even much beyond the mammary line; and to the right of the sternum, should the right ventricle be affected; an upward extension occurs if the auricles are involved. An oval shape of the dull area exists when the dilatation is general. This is not the case in pericardial effusion.

Auscultation. The heart sounds are conspicuous for their feebleness. They are short, the first sound often being no longer than the second. The second sound may not be appreciable in the apex region. The first sound may be reduplicated, or the second sound may be double, giving rise to the gallop rhythm. Murmurs incident to valvular disease are usually present, although a systolic murmur not due to a valve lesion may be heard. There is some difference of opinion concerning this, however. I refer to the murmur attending the so-called "relative insufficiency," *i. e.*, a leakage due to separation of the valve leaflets, in turn due to simple dilatation of the ostium. Murmurs may be present which cannot be ascribed positively to one or the other heart sound (asystolism), such murmurs having existed previously to the dilatation, the latter condition leading to the confusion in respect to rhythm. The enlarged heart impairs the respiration in the left lung, especially over the superior portion, and not infrequently posteriorly also.

Prognosis.—The course of dilatation depends principally upon the amount of hypertrophy which may develop. If the weakening of the heart walls by distention is gradually compensated by the formation of muscular tissue, the unfavorable symptoms will diminish and perhaps disappear, until nutrition becomes impaired and degenerative changes in

the heart develop, when the organ again weakens. After dilatation due to such degeneration appears, it is seldom that improvement, lasting any great length of time, takes place. The symptoms of stasis gradually increase, the lungs usually suffering most. Pulmonary œdema under these circumstances is common and may be the symptom which determines the fatal issue. Many cases go on to general dropsy. Under complete rest and good treatment, however, the patient may live over two or three periods of heart breakdown. We cannot always be sure that the failure is due to a permanent degeneration of the heart muscle, and we should therefore give the patient the benefit of the doubt and pursue most rigid methods of treatment.

Treatment.—Incalculably more important than any other items of treatment are rest and improvement of the general nutrition. Temporary good results may often be attained by the use of remedies which, like *digitalis*, stimulate the heart to its best efforts (and under appropriate circumstances this is advisable treatment), but it is a procedure which is not to be recommended until the influence of rest and a better nutritive state have proven inefficient. The abuse of the stimulation plan is very great. The degree of rest to be recommended must be governed by the needs of the individual case. It is seldom insisted upon for a sufficient length of time nor is it as complete as results justify. A period of complete rest in bed with massage, faradism, proper feeding, etc., has repeatedly afforded me results which have exceeded my most sanguine hopes. The heart is reduced in size, the feeble, irregular, intermitting pulse becomes regular and greatly improved in strength, and the symptoms of circulatory obstruction diminish or disappear. It is strange that so little attention has been given to so valuable a means of treatment, rest being recommended by most authors in a most general way. After the completion of the course in bed, the patient should live upon the level, *i. e.*, not ascend stairs or elevations of any sort, and in every manner possible, for a long period of time, reduce the work of the heart to the minimum amount. The diet should be nutritious, rather concentrated, and as dry as may be compatible with the general condition of the patient. The meals should be small and repeated four or five times daily. Nitrogenous elements should predominate. Unless the patient is lithæmic, red meats may be freely given. Starches and sugars had better be used but moderately. Under suitable circumstances fresh air must be secured plentifully. Sudden exertion or excitement, even though it be pleasurable, must be avoided at all times. Straining at stool may even aggravate the patient's condition, and must be avoided as far as possible. The underclothing should contain considerable wool, and should be roomy in size and sufficiently heavy to afford ample protection.

The medicines recommended under the head of valvular disease are those applicable to the dilated organ, for it is in the main, this weakening

of the heart's walls which is responsible for the symptoms attendant upon valvular disease of the heart.

MYOCARDITIS.

Definition.—Under the name of myocarditis is included a variety of pathological conditions of the heart muscle, some of which are of an inflammatory nature, while others formerly considered such are now recognized as secondary to disease of the coronary arteries, and still others are strictly degenerative.

Varieties.—Myocarditis, in the strict acceptation of the term, that of inflammation of the heart substance, may be acute or chronic. According to the particular structure involved, it may be interstitial or parenchymatous. In the majority of cases both muscular substance and interstitial connective tissue are affected, though one more than the other. The inflammation may take on a suppurative character, resulting in abscess. According to the extent of the inflammatory process it is circumscribed or diffuse.

ACUTE MYOCARDITIS.

Etiology.—Acute diffuse myocarditis is nearly always secondary to one of the acute infectious diseases, especially to diphtheria, typhoid fever, scarlet fever, variola. It has been occasionally observed as a concomitant of rheumatic fever, being generally associated with endo- or pericarditis, which conditions have usually preceded it, and from the direct extension of which inflammatory conditions it is then usually due. A very interesting, though very rare cause of myocarditis, is gonorrhœa. Acute myocarditis secondary to the infectious fevers is far from uncommon. It is said to be present in some degree in all fatal cases of diphtheria, and it is certainly a prolific cause of heart failure in typhoid fever, etc.

Circumscribed myocarditis is nearly always of the suppurative type. It arises from infection with the micro-organisms of suppuration, the sepsis originating from pyæmia, puerperal septicæmia, osteomyelitis, phlebitis, and malignant endocarditis.

Pathology and Morbid Anatomy.—The morbid changes usually involve the left ventricle, the apex of which is nearly always affected. The right ventricle is sometimes diseased, but the auricles generally escape. Microscopically, in diffuse myocarditis, the soft heart substance is found to have scattered through it numerous dark red hæmorrhagic or congested foci. Later, the myocardium becomes yellowish or mottled. The weakening of the cardiac walls causes them to yield under the blood pressure and dilatation results. When the weakness is localized, the dila-

tation is of the character known as "aneurism of the heart," a condition which may also affect the valves of the organ.

In suppurative myocarditis the heart substance is interspersed with small abscesses appearing as minute yellowish-white spots or streaks, or as actual accumulations of pus. Surrounding the suppurative foci are degenerated muscle fibres.

Symptoms.—The symptoms attendant upon acute myocarditis are by no means characteristic, and especially is this the case in view of the frequent association of the disease with the various acute infectious fevers. In general it may be stated that myocarditis may be suspected with good reason when in the course of such affections as diphtheria, typhoid fever, and variola, the pulse becomes small in volume, irregular in rhythm, and rapid in action. Auscultation shows the first sound of the heart to be weak. Sometimes as a result of the relative insufficiency of the orifices accompanying the changes in the myocardium, murmurs are heard. Subjective symptoms referred to the heart are not necessarily present, but may appear in the shape of præcordial distress, dyspnœa, and occasional pain.

Diagnosis.—The diagnosis of acute myocarditis can never be made with any certainty. The data directing attention to its possible existence have already been detailed.

Prognosis.—The mild cases occurring during the course of typhoid fever, diphtheria, and other diseases usually recover. The more severe ones are always to be viewed with considerable apprehension, and end favorably only after a tedious convalescence. Many times this complication results in sudden death following very slight exertion.

Suppurative myocarditis sometimes ends favorably by calcification of the purulent accumulation. As a rule, however, it is fatal.

Treatment.—The first element in the treatment is absolute rest, which must be enforced to such a degree as to prevent the patient from making the slightest attempt to help himself even in the performance of very little offices. Especially must he be forbidden to rise from the recumbent posture. Heart tonics, as digitalis, strophanthus, etc., are positively bad.

The remedies applicable to acute myocarditis are those indicated in adynamic types of the infectious diseases, as *arsenicum, muriatic acid, phosphorus, lachesis,* and the snake poisons generally, also *iodide of arsenic.* The indicating symptoms are rarely found in the heart itself. In impending heart failure *aconite* is a good remedy, but its use should be accompanied by the free administration of alcohol. Hale condemns the use of alcohol in this connection, and advocates the administration of *aromatic spirits of ammonia* in doses of from ten to fifteen drops every hour.

CHRONIC MYOCARDITIS.

Etiology and Pathology.—The etiology and pathological anatomy of chronic myocarditis are so intimately associated that it will be found advantageous to consider these subjects conjointly. A study of cases of this condition shows them to be dependent upon several primary conditions—viz., lesions of the coronary arteries and chronic inflammation of the heart substance. The lesions of the coronary arteries giving rise to this trouble are also of a varied character. They all result in a lessening of calibre, so that the supply of blood furnished the myocardium is inadequate to its needs. In some cases there occurs a sudden obstruction of one of these vessels by either a thrombus or embolus, and the coronary arteries being end arteries, this obstruction is followed by most serious results—*i.e.*, by impairment of nutrition of the anæmic area, and even by sudden death. In the less serious cases, the anæmic area undergoes the changes known as anæmic necrosis. The muscle fibres gradually disappear, fibrous tissue alone remaining. Thus we have produced fibrous myocarditis. A far more frequent cause of the last-mentioned pathological state is a gradual narrowing of the calibre of the coronary arteries, a narrowing that usually accompanies a general arterio-sclerosis or obliterative endarteritis. Occasionally the coronary arteries are obstructed by septic emboli in the course of pyæmia. In such a case minute abscesses are liable to form.

The strictly inflammatory affections of the myocardium may involve either the interstitial connective tissue or the muscular elements themselves, generally both, though one to a much greater extent than the other. The parenchymatous form follows the specific fevers, and especially rheumatic inflammation of the peri- and endocardium. The muscle changes are usually general. Virchow has described them as cloudy swelling, the tissues being soft and sometimes presenting a waxen appearance. The muscle fibres lose their striations, and contain large numbers of albuminous granules, which may later be replaced by fat drops.

The changes in myocarditis, no matter what the cause, may be either diffuse or circumscribed. In the latter case the left ventricle, the septum, and the papillary muscles are the parts generally involved. In the diffuse cases the heart is frequently enlarged from connective tissue overgrowth. Sometimes the muscle elements themselves are hypertrophied, especially when general arterio-sclerosis is present.

Symptomatology.—The symptoms of chronic myocarditis are suggestive of that condition only when studied as a whole. In many cases they may be entirely absent, and only assert themselves when the disease has become well advanced. They indicate failing cardiac function, and consist of dyspnœa, especially on slight exertion, anginal at-

tacks, rapid or arrhythmic, and, in some cases, an exceedingly slow pulse. Cerebral symptoms are prominent features of some cases, and exhibit themselves in the form of attacks of syncope or pseudo-apoplectic seizures, mental weakness, delirium and chronic mania.

Physical examination reveals enlargement of the left ventricle, with weakness and muffling of the heart sounds. Owing to increased tension in the pulmonary circulation, the pulmonary second sound of the heart is accentuated or even reduplicated. The heart is found to be irregular in both force and frequency.

In some cases symptoms referred to the digestive system, and even to other organs, are manifested.

Diagnosis.—This rests upon the physical signs in conjunction with the presence of enfeebled cardiac action and the absence of recognizable valvular lesions.

Prognosis.—The prognosis of chronic myocarditis must always be guarded. Extensive changes in the myocardium are not inconsistent with long life if the patient pays careful attention to rules of living. A cure of the condition is, however, out of the question. With high degrees of heart feebleness comes disturbance of the pulmonary system, collections of fluid in the serous cavities, engorgement and swelling of the abdominal organs, bronchitis, hæmorrhagic infarctions, pulmonary œdema and bloodspitting. Sudden death often ensues.

Treatment.—Rest to the enfeebled heart must be secured by every possible means. But it is wise also to see to it that the patient has the fresh air daily. A light, nutritious diet, the correction of any disorder of digestion, and, as far as possible, of any diathetic condition, are the principal items of treatment. Should syphilis appear to be the cause, the *iodide of potassium* should not be passed by without giving it in full doses. *Biniodide of mercury* 2x, *chloride of gold and sodium* 2x, and the *iodide of arsenic*, are also valuable remedies in these cases. Should the heart be greatly enfeebled, it may be well to employ cardiac stimulants and tonics, such as *strychnia*, *caffeine*, *digitalis*, etc., for a time only; but the less such a heart is whipped into activity, and the more it is nourished and rested, the better, as a rule, it will be for the patient.

FATTY DEGENERATION OF THE HEART.

Fatty changes in the heart occur in several forms, namely: (1) A fatty infiltration of the heart substance, in which the adipose tissue beneath the pericardium increases in quantity and even invades the substance of the organ separating its muscular fibres from each other, and by reason of the pressure thus exerted, producing degeneration of the muscular structure. This variety must be clearly differentiated from (2) true fatty metamorphosis, or fatty degeneration of the heart, in which the protoplasm of the muscular fibres is transformed into fat. The sarcous

matter thus losing in substance undergoes a loss of contractile power. (3) A form known as pigmentary degeneration, or brown atrophy, which is characterized by pigmentary deposits within the muscular fibres in association with a degree of fatty change.

In simple fatty heart (*cor adiposum*), there is an accumulation of fat upon the exterior of the organ, the collection being most conspicuous in the auriculo-ventricular depressions, about the apex, and perhaps along the course of the coronary arteries; *i. e.*, in locations in which we normally find the largest amount of adipose tissue. With its increase the adipose tissue envelopes the heart, grows into it, separating its muscular fibres, pressing upon them and the bloodvessels, and leading to a degree of atrophy and fatty metamorphosis of the muscular fibres. This condition of fatty infiltration is favored by alcoholic excesses, and inordinate indulgence in fatty, saccharine and starchy foods, although many obese persons (which class furnishes the largest number of cases) do not partake of such substances in excess. Impaired nutrition due to the feeble circulation of old age appears to be the cause in certain cases.

Fatty degeneration proper represents a metamorphosis of the muscle elements into fat, and is significant of a serious impairment of nutrition. The distribution of the lesions varies; they may be general or they may occur in local patches or streaks. The layer of tissue immediately beneath the pericardium may be especially or solely involved, or the fatty degeneration may be limited, *e. g.*, to the ventricles. When the changes are complete the substance of the organ is softened, yellowish, and if the lesion is a general one, the heart may be somewhat enlarged because of dilatation of its weakened walls. The streaky development of fatty degeneration gives rise to a peculiar alteration exhibiting itself in alternations of yellow and reddish lines throughout the heart substance. The left ventricle is the part most frequently attacked. The local regions most frequently involved are the musculi papillares, the columnæ carneæ, and the muscular fibres immediately beneath the endocardium. The general color of the diseased parts is a pale yellow or brownish-yellow interspersed with streaks and mottlings.

Microscopically the muscular fibres are shown to have lost, partially, their transverse markings and to contain granules arranged variously, *i. e.*, longitudinally, transversely, etc. These granules finally coalesce and form minute oil drops. Thus, the structure is finally disintegrated, until in some places there only remains debris of a fatty and granular character.

Etiology.—Fatty degeneration of the heart is quite common, occurring secondarily to the fatty accumulation just considered, but more frequently as a result of a great variety of conditions having the effect of depressing the heart's nutrition, especially from other chronic cardiac affections. Among the latter may be mentioned, as of especial note,

disease of the coronary arteries. It may follow upon the parenchymatous degeneration accompanying acute infectious diseases, and is a frequently associated condition of the various cachexias and anæmias. In the aged, it is quite common to find a general senile fatty degeneration pervading the heart, arteries, diaphragm, etc. The ceaseless activity of the organ is probably one of the most important reasons for the great frequency of fatty changes in its muscular substance. Certain drugs, especially phosphorus, are capable of inducing fatty metamorphosis.

Pigmentary degeneration or "brown atrophy" of the heart, which is frequently associated with fatty degeneration, is considered under the head of "cardiac atrophy."

Fatty infiltration arises from the same conditions as cause general accumulations of fat. In some cases it is hereditary, while in others it results from peculiarities in diet and excessive indulgence in alcoholic beverages. It sometimes comes with the increasing flesh of advancing years.

Symptomatology.—The symptoms of fatty infiltration are by no means conclusive. They consist of inability to walk rapidly or ascend heights without experiencing dyspnœa or shortness of breath; but this symptom, it must be remembered, may be occasioned by the extra exertion required by reason of the patient's abnormally large weight. Syncope sometimes occurs. The extremities are often cold. The pulse is feeble, but always regular in rhythm, though often increased in frequency. Bronchial symptoms are sometimes present. Præcordial oppression, and even pain may be occasionally a source of complaint. The physical signs are likewise unsatisfactory. The examination of the heart is conducted with difficulty owing to the thickness of the chest walls. The area of dulness may be increased owing to the large deposit of fat. The heart-beat is weak, and its sounds muffled.

The symptoms of fatty degeneration of the heart are those of myocardial degenerations in general. The prominent clinical feature is heart feebleness which may be combined with disturbances of rhythm. It is undoubtedly true, however, that symptoms do not always enable us to diagnosticate the condition with certainty. Considerable degrees of degeneration are often discovered post-mortem whose existence was not suspected during life, and it is sometimes equally a matter of surprise to find a very mild lesion leading to a very grave result. The symptoms are therefore in many cases unreliable. Usually there is an irregularly progressive increase in the heart's feebleness and disturbance of rhythm, and this is combined with evidence of dilatation. There are dyspnœa especially on exertion, præcordial distress, anginal attacks, sense of prostration of mind and body, syncopal attacks and later, œdema, indications of hyperæmia of the abdominal organs, and perhaps emboli of the heart, lungs, etc., in fact the entire group of phenomena arising from cardiac insufficiency.

The disturbances of heart action are found in slow pulse, palpitation and arrhythmia. The former is experienced especially in cases in which there has been hypertrophy, and must be regarded as evidence of inability in the cardiac walls. The irregularity is manifested especially during or after exertion, the severity of the process being indicated by the ease with which the arrhythmia is produced, as well as by the special features of that particular symptom. In some cases it may be produced by the slight straining necessary at stool or the mental disturbance attendant upon slight emotions. A regular arrhythmia, *i. e.*, one in which the pulse intermits at stated intervals, *e. g.*, every third or fourth beat, is not of as evil omen as one in which a beat is dropped irregularly or when the intermittency occurs among a number of other beats irregular in both force and rhythm. Indeed an intermittency of the first-mentioned character is not inconsistent with a long life.

The cardiac insufficiency leads naturally to supply of blood to the different viscera inadequate to their functional requirements. This is manifested in the brain by quite a variety of clinical phenomena. Cerebral anæmia leads to attacks of syncope. Change in mental force is apparent. The active brain becomes sluggish. Mental tasks which were at one time easy, are now difficult or even impossible.

The general muscular system is likewise weakened. This is exhibited in every movement of the patient, who is uncertain and sluggish in gait.

The peculiar modification of respiratory rhythm known as the Cheyne-Stokes respiration is regarded by many as especially significant of fatty degeneration of the heart, though they all acknowledge that this symptom occurs in other conditions. Pepper does not regard this respiration as of especial diagnostic value in this condition, believing that it occurs with far greater frequency in uræmia.

The corneal change known as the arcus senilis has been suggested as an associated symptom of fatty degeneration of the heart; but this is denied by many, who admit, however, that this condition when present in the comparatively young, and associated with general arterial changes, is of considerable diagnostic value. Flint expresses his opinion in these words: "It may be regarded as at least denoting a condition of the system favorable for fatty degeneration, and taken in connection with the symptoms and signs relating directly to the heart, it is not without diagnostic import."

Physical Signs.—The physical signs of uncomplicated fatty degeneration of the heart are largely negative in character. Palpation of course shows an abnormally weak impulse, the apex beat, however, being at the normal point. In some cases the heart-beats may be absolutely imperceptible. Percussion shows no changes in the area of cardiac dulness. Auscultation reveals weakness or absence of the muscu-

lar element of the first sound, the part which is produced by the closure of the auriculo-ventricular valves alone remains. The silence between the first and second sounds is prolonged.

Diagnosis.—The negative character of the physical signs makes the diagnosis of fatty degeneration of the heart rest very largely on the exclusion of other conditions which resemble it, and which produce the clinical phenomena of failing heart. Valvular lesions must be excluded. It is to be remembered in this connection that very often as the heart loses in force, a murmur which had hitherto been readily discernible, disappears. And again, fatty degeneration not infrequently occurs in association with valvular anomalies. A correct conclusion is possible in these cases when the clinical course of the case is studied, and the influence of each phenomenon carefully weighed. When the heart weakness is disproportionate to the dilatation or valvular insufficiency, fatty heart may be reasonably suspected.

With valvular trouble and dilatation out of the question, the occurring of the symptoms of cardiac weakness already outlined, in persons who have passed the middle period of life, and who are of indolent or luxurious habits, a diagnosis of fatty heart is more than reasonable.

Prognosis.—Fatty degeneration of the heart is to a great extent irremediable, though much may sometimes be done to arrest the process and relieve the symptoms. It should be remembered also that cases differ very greatly and require individualization. It has even been suggested by high authority that great improvement may be effected by appropriate treatment. The prognostic indications afforded by the pulse have already been stated. One must not lose sight of the fact that in not the least promising cases, a sudden termination may occur, and that in any event, symptoms of imperfect compensation may appear unexpectedly.

As to the relation between sudden death and fatty degeneration of the heart, Sansom considers it to be for the most part a bugbear as the cause of such a catastrophe, believing that such cardiac degeneration is very infrequent. He adds, however, "of course I do not dispute the influence of such degeneration in causing deaths that are not sudden." When sudden death results from the condition under consideration it usually follows some unusual or injudicious exertion. Even in cases in which death takes place during sleep, inquiry will often show that the patient has been unwisely active during the preceding day.

Treatment.—The indications for treatment are the same as those for dilated heart and chronic myocarditis. Rest, mental and physical, the best hygienic conditions, the avoidance of alcoholics and tobacco, a simple light dietary carefully adapted to the condition of the patient, having especial regard to dyspeptic and diathetic conditions, are most important. *Arsenicum, kalmia latifolia, iodine, kali hyd., aurum mur., phosphorus,* and *digitalis,* are the principal remedies. When cardiac stimulation is neces-

sary, strychnia in doses of one one-hundredth of a grain or tincture of digitalis in doses of five drops may be given several times daily. *Sulphate of sparteine* 1x or *agaricine* 1x may also be used. They should only be employed, however, when compensation is failing, and not before that time. Under no circumstances should they be resorted to rashly or without due regard to the effect desired of them. A warning respecting the "whipping up" of a weak heart has already been sounded in these pages. In fatty degeneration of the heart this warning is of double importance. Sir Wm. Jenner once said, "fatty degeneration of the heart is a conservative process," and he was right, for associated with this pathological state is a general arterial degeneration. Under these conditions it is a wise provision on the part of nature that the heart is weak, for did it possess its wonted force, it might readily cause rupture of cerebral bloodvessels,—an accident that occurs with too great frequency even under existing conditions,—with disastrous results. To administer cardiac stimulants without judgment must therefore be in the highest degree irrational.

ATROPHY OF THE HEART.

Etiology.—Atrophy of the heart may be either local or general, congenital or acquired. The congenitally small heart is but rarely met with, and then usually in girls whose bodily development has been retarded. Such subjects are generally chlorotic and in possession of poorly developed sexual organs. The bloodvessels throughout the body are imperfectly developed, and general nutrition is consequently impaired.

Local atrophy occurs with especial frequency in conjunction with stenosis of the mitral orifice, the diminished growth being attributable to the inadequate supply of blood furnished the left ventricle. It may also result from the connective tissue overgrowth of myocardial degenerations.

A very appreciable general wasting of the heart is of common occurrence in quite a variety of wasting diseases, as phthisis, carcinoma and diabetes. Some cases arise as the result of mechanical influences, *i. e.*, the compression of tumors, pericardial accumulations, and the contraction of pericardial adhesions. Changes in the coronary arteries, resulting in imperfect local nutrition, may cause atrophy of the heart.

Morbid Anatomy.—The organ is greatly reduced in size, the extent varying according to the case. Quain reports one case in which the heart weighed but one ounce and fourteen drachms, and Bramwell another nearly as small, the weight being two ounces thirteen drachms. The congenitally small heart of an adult resembles in general appearances that of a child. The various portions are well proportioned. In other words, the heart is perfect but small. In the varieties due to

disease the cavities are not only small, but the myocardium soft and anæmic, the walls are thinned, and the superficial fat removed. The pericardial sac contains an abnormal quantity of fluid.

Symptoms.—The frequent association of a small heart and vascular organs with chlorosis is now well established. The symptoms of cardiac atrophy are not especially distinctive. The patient is far more apt to be troubled in the acquired form by the symptoms of the causative condition; the weakened heart, as a rule, being entirely adequate to the little nutrition required by the generally starved body. Sometimes the usual symptoms of weak and irritable heart are present.

The physical signs are those naturally expected of a weak heart under the normal size. Too much stress must not be placed on diminished cardiac dulness, for pulmonary emphysema may give rise to this sign in cases in which the heart is even enlarged.

Prognosis.—Atrophy of the heart is incurable. The condition does not seem to hazard life to any great extent, as the heart is nearly always equal to the task of furnishing all demands made upon it by the enfeebled body.

Treatment.—So far as the heart itself is concerned, treatment is of little value. All therapeutic measures should be directed to the primary disease. It is best to prescribe rest, a general tonic plan of treatment, and administer remedies as indicated by such symptoms as may arise from time to time.

ANEURISM OF THE HEART AND ITS VALVES.

Localized dilatations may be observed involving the heart or its valves, and to these the name of aneurism has been applied.

(1) **Aneurism of the Heart Walls.**—This condition consists in a localized degeneration and sacculation of the cardiac walls, the left ventricle being the part most frequently involved, and especially in the anterior apical and apical regions. The rapidity of development of the condition varies greatly in different cases, thus leading to the division into acute and chronic cases. The latter occur almost exclusively following malignant endocarditis, or the rapid softening sometimes resulting from embolism of a branch of the coronary artery, the bursting of a myocardial abscess, etc. Those of slower formation follow the various forms of myocardial degeneration. Men, especially those past middle life, are more frequently affected than are women. The size of the cardiac aneurism presents great variations. Sometimes it is a merely appreciable distention, while in others it is a sac equalling or exceeding in size that of the heart itself. It may communicate with the cavity of the heart by such a large opening as to constitute a bulging, or consists of a sacculated distention communicating with the heart by a narrow opening. It is interesting to observe that the aneurism does not always appear externally as

a protrusion, but may burrow within the heart wall and thus become obscured, or it may extend upward between the great bloodvessels. In a case of the author's, the protrusion was inward into the left ventricle and was due to rupture of one of the coronary arteries. It is a question whether such varieties are entitled to the name of aneurism. In some cases the pericardium has been observed to be dissected from the heart, so to speak, by the blood pressure, resulting in the formation of a blood jacket, which may extend almost the entire way round the organ. An aneurism may have several extensions or communicating pouches. Ordinarily but one aneurism is found, but specimens exhibiting a number—as many as four—are contained in quite a number of hospital museums.

(2) **Aneurism of the Valves** usually results from the destructive changes of malignant endocarditis, although more chronic lesions may prove antecedent. Such an aneurism appears as a globular projection upon one of the valve surfaces in the direction of the greatest blood pressure. If affecting the aortic valves,—the most common situation,—the pouch projects into the left ventricle, while if formed in a mitral curtain, the aneurismal pouch is upon the auricular side. As in aneurism of the heart wall, there may be several pouches. The delicacy of the tissues involved often leads to rupture and consequent valvular insufficiency.

Symptoms Diagnosis, etc. A diagnosis is seldom or never made during life, as there is nothing definite in the symptoms, and the physical signs are those of dilatation of the heart's cavities, from which condition as well as from aneurism of the large vessels, aneurism of the heart can hardly be separated. The symptoms are often complicated with those of valvular or other cardiac diseases with which this condition is associated. Death may result from syncope or from rupture into the pericardium, the last mentioned, according to Legg, not being so common an accident as generally believed. Quite a percentage of cases die of pulmonary inflammation.

Prognosis, Treatment, etc. Aneurism of the heart is, of course, incurable, and as it cannot be differentiated from other chronic degenerative lesions, it must be treated upon the general principles involved in the management of that class of affections.

Functional Disorders of the Heart.

The various forms of disorder of function occurring independently of any structural alteration of the heart are classed as neuroses or functional disorders. They are characterized by alterations in frequency, force, rhythm and sounds. The same alterations are also frequently symptomatic of organic lesions.

Disordered innervation may be intrinsic, *i. e.*, originating within the heart, or extrinsic. The latter cases may furthermore be divided into the centric and the reflex.

PALPITATION OF THE HEART.

Palpitation of the heart is to be regarded as a compound symptom, the essential features of which are abnormal force and rhythm, and perhaps, frequency of the heart's action, of all of which the patient is subjectively conscious. The increased force is usually more apparent than real, because it appeals directly to the patient's sensations. Undue force with or without increased frequency is a symptom of cardiac hypertrophy, but is then more of an objective than of a subjective character. In true palpitation the heart's action is increased in frequency. Notwithstanding the obtrusiveness of the heart's action to the patient, palpitation indicates weakness rather than strength of that organ. The associated complaints are always disproportionately severe as compared with the objective conditions.

Briefly then, palpitation of the heart is the subjective evidence of forcible or rapid action.

Etiology.—Palpitation is often the result of heart lesions, but it is far more frequently due to causes which are entirely independent of disease of that organ. Notwithstanding the latter fact, this symptom always calls for the most searching investigation into the condition of the heart.

The non-cardiac causes of palpitation are ever a matter of great clinical interest, ofttimes requiring considerable acumen for their discovery. They include not only a great variety of nervous influences, but the present and past habits and diseases of the sufferer, and the drugs and stimulants to which he has accustomed himself.

Palpitation Due to Nervous Influences. The morbid influences giving rise to this condition may emanate from the brain, as when palpitation results from the emotions, viz: sorrow, fright, joy, etc. Under this

head may also be included cases arising from organic lesions of the central nervous system, as cerebral congestion, cerebral hæmorrhages, and softening and tumors of the brain. Functional nervous disturbances, however, as hysteria and neurasthenia, furnish most of the cases of palpitation arising from nervous causes.

Diseases and bad habits ultimating in exhaustion of the nervous system account for a large percentage of cases. Loss of blood, the various anæmias, venereal excesses, masturbation, and overwork of the nervous system with insufficient exercise, and too much confinement in illy-ventilated rooms, are common causes. The prominence of palpitation in exophthalmic goitre constitutes an important feature of that disease. Persons subject to privation and unusual muscular exertion, especially if the latter be combined with excitement, may develop palpitation with pain and dyspnœa, as exemplified in citizen soldiery unused to the conditions of an active campaign. Enlargement of the heart is not rare as a consequence of this variety of palpitation.

Reflex causes are very common. They originate for the most part in the abdominal and pelvic viscera, the stomach in particular being at fault. Sometimes attacks are excited by a simple indigestion; indeed, in certain individuals palpitation may prove to be the sole evidence of an indigestion. In other cases paroxysms are brought on by certain articles of diet, the offending food being one which habitually disagrees with the patient.

Various drugs and stimulants excite palpitation of the heart, whether through action upon the muscular substance of the organ, or upon its complicated nervous supply, is not altogether clear. Tea, coffee, tobacco, and alcohol are the most important of these. Individual susceptibility undoubtedly plays a most important part in this matter.

The association of palpitation of the heart with organic cardiac diseases has already been considered in connection with those affections.

Palpitation may sometimes be a symptom of cirrhotic kidneys and arterio-sclerosis.

Symptomatology.—In connection with the objective evidences of palpitation there are certain subjective complaints which usually seem out of proportion to the physical evidences of disease. This, as stated, constitutes one of the most prominent features of simple nervous palpitation. In well-marked cases there are sensations of fluttering, violent pulsation, a feeling as if the heart were rising into the throat, with impending suffocation, etc. The heart-beat is often strong, diffuse and visible to the bystanders. The pulse is often rapid, ranging at times from 120 to 150 per minute. Patients are generally very nervous and restless and have a fear of death during the attacks. Cardiac pain is not rare, and is usually relieved by pressure. It may be anginal in character. Respiration is usually disturbed, the respiratory efforts being frequent

irregular and sighing. Dyspnœa may enforce the sitting position, should the patient be lying, in some cases, while in others it may compel him to rise and move about in a restless manner. In severe attacks the face may be reddened, or pale and clammy, with faintness. In paroxysmal attacks the onset and decline are usually sudden. The seizures may last but a few minutes, or they may continue for hours or days. In exophthalmic goitre the palpitation constitutes a most persistent symptom. Physical examination as a rule gives negative results except that inspection shows unusual motion in the præcordial region, and palpation discovers quick, spasmodic, and sometimes powerful cardiac action. The exceptions are found in an occasional exaggeration of the normal sounds, besides, possibly, the presence of hypertrophy in old cases brought about by the cardiac overaction.

Diagnosis.—Usually the diagnosis is easily made. A cause for the trouble is often readily apparent. The absence of all evidences of organic disease of the heart is strongly suggestive of a general origin for the trouble, to discern which the most painstaking search must perhaps be made. If palpitation is persistent, exophthalmic goitre, alcoholism, the abuse of tobacco, etc., should be suspected. When the trouble results from uterine and ovarian disease, dietetic errors, emotional influences, etc., the etiological relationship to the same is usually clear. Obscure cases, however, will be met with. Thus Skoda relates one due to calcareous disease, involving the great cardiac as well as the phrenic nerves. The palpitation of organic disease is usually excited by exertion.

Prognosis.—This depends almost entirely upon the cause of the trouble. There is seldom any danger of death unless the heart or arteries are highly degenerated. In old cases, the excessive action of the heart brings about hypertrophy of that organ. Sometimes the violent overaction of the heart in conjunction with vascular degeneration leads to cerebral hæmorrhage.

TACHYCARDIA.

Synonyms.—Paroxysmal hurry of the heart; rapid heart.

Tachycardia is characterized especially by a rapid action of the heart, which is usually developed paroxysmally, but which may also be a constant phenomenon and persist as such for years. It cannot be positively separated from palpitation, as it is frequently associated with subjective discomfort, though a separation seems warrantable, as in most marked cases of tachycardia there is an entire absence of cardiac sensations. Brunton has remarked, "cases of tachycardia seem to be so much associated with nervous palpitation, with angina pectoris, and with asthma, that it is difficult to draw a distinct line between them."

Etiology.—The frequency of the heart's action varies considerably within the bounds of health. With some persons quite rapid cardiac

action is a physiological condition. In the majority the action of the heart is readily accelerated by certain influences, as exercise, the emotions and excitement. With some this symptom can be brought on voluntarily at any time. Age greatly influences the frequency of the heart beats, they being more frequent in the young than in the old. Conditions like these must not be mistaken for tachycardia. In a young man, who had recently been incorrectly informed that he suffered from heart disease, any attempt at an examination would raise the pulse to 160 or 180 per minute; and it would continue at this high point for an hour or more. A satisfactory examination was not made possible until I had instructed him to come frequently to my consulting room and remain there for a considerable time. In this way the excitement arising from the examination was finally overcome, and then it was most conclusively proved that his heart was perfectly normal. This young man had grown rapidly, was rather anæmic, and was, I suspected, addicted to self-abuse. His case represents a large class especially prone to "paroxysmal hurry" of the heart, whether of the above described simple nature, or distinctly tachycardial. They all possess irritable nervous systems, and many of them have been exposed to causes which tend to nervous depression. Some cases of tachycardia result from excessive indulgence in alcohol or tobacco; others follow exhausting diseases and the infectious fevers.

The nervous mechanism of the heart may be involved in lesions which excite tachycardia. As may be surmised, this variety is usually very persistent. The causative lesions are of great variety. For example, in the vicinity of the heart are numerous lymphatic glands, the bronchial and the tracheal, which, becoming enlarged, may exert pressure on the vagus and seriously impair its functions, and thus produce the condition under study. In some cases of multiple neuritis the pathological process invades the sympathetic fibres of the heart, and thus tachycardia is caused. Sometimes it originates from irritation of distant nerve trunks, as exemplified in cases arising from the pressure of tumors on the nerve trunks of the neck. Lesions of the central nervous system, *e.g.*, in the medulla or upper portion of the spinal cord, are responsible for quite a percentage of cases of the most typical character. Certain diseases of the nervous system, especially locomotor ataxia, and tumors of the brain, may be accompanied by a most persistent rise in the pulse-rate.

Reflex influences excite tachycardia. These are exceedingly varied, ranging as they do from organic lesions of the heart to disorders of the abdominal and pelvic organs. While many cases of tachycardia are regarded as of neurotic origin, these grow rapidly less as our knowledge of disease in general increases. A discharging lesion of the accelerator nerves of the heart has been suggested by Wood as an occasional cause. A most remarkable example of tachycardia dependent upon reflex influences is the case reported by Lainé, which appeared very much

like one of essential paroxysmal tachycardia, but it disappeared promptly on the discharge of a few calculi *per urethram*. While tachycardia is so frequently a functional state, the fact that it is sometimes an expression of organic disease of various organs, demands a careful physical examination in every case.

Symptomatology.—As already intimated, tachycardia may be a continuous condition of rapid heart action, or, and this is the more frequent, it may occur in paroxysms lasting from a few minutes to several hours or even days. The great frequency of the heart's action is of course the most prominent symptom, and is especially pronounced in the paroxysmal cases. Rates of 200 or more beats to the minute are by no means unusual. In the paroxysmal cases the onset is usually sudden, and without premonitory symptoms. The pulse is weak and small, and even irregular. Every pulsation of the heart may not be represented by a pulse beat. The respirations may be either rapid, difficult, or undisturbed. Dyspnœa when present is generally increased by the recumbent posture. The combination of excessive rapidity of the pulse with almost normal respirations constitutes a most curious clinical feature of some cases. The patient may or may not have a painful consciousness of the heart's action. Sensations of oppression and pain are common. Pains when present are often angina-like in character. During the attacks the face may flush, the arteries throb, and headaches, vertigo, flashes, noises in the head, and faintness often attend. The patient usually looks anxious and is restless. In females, hysteroid symptoms may be associated. The speech is altered, *e. g.*, choppy, and it may even be that the patient lowers his tones to a whisper.

Physical examination reveals an extended impulse more or less increased in power. The aortic second sound is relatively much weaker than is the first sound, due to the imperfect distention of the arteries by the rapid but imperfectly acting left ventricle. The pulmonic second sound may be accentuated. An apical systolic murmur is sometimes present. A murmur is also common over the carotids. Murmurs are present only during the attack, unless lesions of the heart exist or the

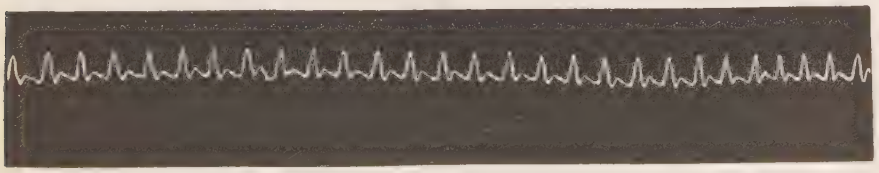


Fig. 12.—Pulse Tracing in a Case of Tachycardia.

patient is anæmic. Slight dilatation may be demonstrable. The sphygmographic tracing exhibits a rapidly acting heart with low arterial tension, which latter condition many observers consider an

important cause of tachycardial attacks. In long-standing cases secondary conditions arise. Thus there may be present congestion of the liver, scanty urine, cough, and dyspnœa.

Diagnosis.—The essential features of this affection are so pronounced that the diagnosis is usually easy, although we sometimes find it impossible to draw a line of separation between tachycardia and simple palpitation. The symptomatic variety can usually be identified after careful observations of the heart. Affections of the valves and mural degenerations may be detected by a physical examination and attention to the history and symptoms of the case. In all instances search for lesions of the brain and spinal cord, intra-thoracic difficulties, and for any other possible disease, must be made. The influence of exophthalmic goitre, hysteria and other neuroses must be remembered.

Prognosis.—This depends very largely upon the cause of the difficulty. Tachycardia is not essentially dangerous, but the influence of violent attacks upon an elderly degenerate vascular system is bad. Hypertrophy is the necessary result of frequent attacks. A cure is the exception and much encouragement cannot be given honestly. Occasional attacks are not inconsistent with good health in the intervals. The same rate of attacks and character of general health may continue with little changes for many years. A termination by heart failure is not a rare result.

Treatment of Palpitation and Tachycardia.—It is hardly practicable to separate the treatment of cardiac affections represented by rapid action. The therapeutic principles involved are first to discover, if possible, the cause of the difficulty, and endeavor to remove the same; secondly, to improve the general health; and third, to relieve the attacks. Considering these conditions reversely, the patient during the attacks should be put at perfect rest, and all the special senses protected from irritation. Therefore, a dark, quiet room, with freedom from excitement, etc., is demanded. The patient should be quieted as much as possible by assurances of the absence of all danger. Ice applied to the præcordium is universally recommended as a remedy, the use of which I can heartily endorse. The same remedy often gives relief when applied to the epigastrium, and in women over the ovarian region. Ice taken into the stomach has apparently proved of value in some cases. Hot foot-baths are sometimes efficacious. Faradism to the region of the heart has been recommended; but I have never used it. A hot bath has given relief in some cases. If the patient is weak, we may suggest as promoters of general health and modifiers of existing lesions, that in the intervals of the attacks, everything calculated to improve general nutrition should be considered. A careful regulation of the life of the patient is necessary as to exercise, diet, sleep, sexual indulgence, etc. The latter is especially pernicious. Tobacco, alcohol, tea and coffee, are

heart excitants and should be forbidden. In obstinate cases, rest with forced nutrition, perhaps combined with massage, galvanization of the sympathetic and vagus for from six to eight minutes daily, and cold sponging with friction, are valuable.

As to medicinal treatment, I have not observed, nor is there evidence in literature of very marked or lasting results from any single medicine. Medicines undoubtedly do good, but one must usually wait long for action, and that of a preventive character, due to their influence on the general health or upon lesions causative of the heart symptoms. In the ordinary paroxysmal variety, without apparent organic cause, therefore probably cases of neurotic origin, *aconite*, *spigelia*, *coffea*, *chamomilla*, *ignatia*, and the *valerianiate of ammonia*, and *zinc*, have evidently been of some benefit in lessening the severity of the attacks. *Moschus* constitutes a very important remedy for the relief of the patient during the paroxysms of palpitation. It is especially adapted to hysterical cases. *Coffea* often relieves palpitation of neurotic subjects attended by considerable excitement. Lancinating pains in the præcordial region are experienced, and the paroxysm is succeeded by a profuse discharge of urine. *Nux moschata*, like moschus, is adapted to hysterical subjects, but the paroxysms of palpitation are accompanied by faintness. *Nux vomica* is the remedy in many cases associated with indigestion. There is sense of oppression in the epigastrium, and aggravation of the cardiac symptoms after eating. *China* is valuable for cases dependent upon anæmia and flatulent dyspepsia. *Carbo veg.* is also useful in dyspeptic cases with tympanitic distention of the abdomen. The pulse is apt to be intermittent, especially after eating and on lying down. *Gelsemium* is particularly suitable in paroxysms arising from the abuse of tobacco. Arterial depressants, such as *aconite* and *veratrum viride*, are advocated by some and are undoubtedly of some value in obstinate cases. When other remedies fail, we may follow the example of the old school and administer an opiate. The *muriate of morphia* in doses of from one-twelfth to one-quarter of a grain hypodermatically is the best form of administration. Palliative treatment of this active character is, as a rule, unwise, and should not be resorted to indiscriminately.

Only the most general suggestions can be offered relative to the management of the interparoxysmal period. If myocardial or nerve lesions can be made out or are suspected, *chloride of gold* in the second decimal trituration should be given regularly for an extended period. It has proven of unquestionable value in my own experience. If a syphilitic basis exists the same medicine may be useful, but *iodide of potassium* in large doses should then be given, and, if necessary, for a prolonged period. I found this very valuable treatment in a case of syphilitic myocarditis associated with tachycardia. The actual cautery has proven equally efficacious in some cases. It should be applied over

the base of the heart, as suggested by Poulet for angina pectoris. If disorders of the alimentary canal seem to excite attacks, *nux vomica*, *pulsatilla*, *sepia* and *ignatia* should not be forgotten. In hysterical patients, the *valerianate of ammonia* in grain doses, frequently repeated, is to be recommended. Should valvular or other lesions of the heart exist, the treatment will be largely determined by the nature of the affection. Poulet has lately used with advantage the *coronilla varia* in doses of from thirty to sixty drops of the tincture, made from the entire plant, three times daily.

BRACHYCARDIA.

Synonyms.—Bradycardia; slow heart.

An abnormally slow acting heart may be a physiological condition. It has been noted as affecting several members of a family. A normal pulse of sixty per minute or thereabouts is not uncommon, and one of forty, or even thirty, has been often enough observed. A pulse of forty must be regarded as indicative of a condition of gravity. It is indeed a question whether or not a cardiac lesion of some kind does not underlie most of these so-called physiological cases. Many such have been reported in which, after a lapse of years, fatal heart lesions were manifested. The abnormally slow pulse may occur either as a permanent or as a paroxysmal condition.

Etiology.—"Slow heart" may be attendant upon various heart lesions, especially upon degeneration of the myocardium and aorta. While it often accompanies valvular affections in their late stages, this is seldom the case unless myocardial changes coexist. The latter is therefore evidently the more important of the causal conditions. At one time there existed a strong feeling that fatty metamorphosis was especially related to brachycardia, but such has not been proven. While degeneration of the myocardium seems most important, there is no variety of degenerative change which can be singled out as the exclusive cause, unless it be fatty change combined with obstruction of the coronary arteries.

Brachycardia is observed most frequently after child-birth, acute fevers, the infectious diseases generally, affections of the digestive organs, jaundice, Bright's disease, especially with uræmic symptoms, indeed in most affections in which morbid products circulate in the blood. Huchard believes that the majority of cases are caused by arteriosclerosis and a genuine bulbar ischæmia. Very often, he says, the slow pulse is accompanied by attacks of vertigo and syncope.

Some pulmonary affections appear to excite it.

Nervous lesions constitute a most important group of causes. They act reflexly, or through involvement of the nervous supply of the heart. Injuries of the upper portion of the spinal cord, as well as of the cranium, tumors, inflammation, hæmorrhages, etc., within the skull, have all been

noted as associated with brachycardia. The interesting observation of Czermak, that he was able to arrest his heart's action for several beats by compression of the pneumogastric nerve against a cervical node, has been frequently cited. In a certain number of cases the symptom must be considered as a neurosis. It may result from the impression made by a serious attack of pain or emotional disturbance. It is frequently associated with epilepsy. Sansom states that there is usually some disorder of rhythm in these cases. Hysteria, hypochondriasis, melancholia, mania, general paresis, may each be attended by slow pulse.

The splendid observations of Reigel upon over 1,000 cases of slow pulse deserve mention. The majority of these followed the acute fevers. Next in order of frequency came gastro-intestinal disease in 379. The vagus is especially concerned in the development of brachycardia, many cases resulting from irritation of this nerve at its origin or in some portions of its trunk. In affections below the diaphragm it is probably stimulated reflexly.

Symptoms.—In the paroxysmal variety the onset of the attack may be with or without warning symptoms. The pulse is slow. The rate of pulsation should always be estimated at the apex, not by the pulse. The pulse and apex impact are usually weak. Rates of pulsation under ten have been observed. During the attack there may be faintness, or even complete unconsciousness. Muscular twitchings may attend the cardiac disturbance, and exceptionally even epileptiform spasms may occur. Such cases, however, are nearly always epilepsy, with brachycardia as a prominent symptom, appearing, for example, as an aura.

Diagnosis.—Unless the diagnosis of brachycardia be based upon a count made at the heart, error may result, as in certain conditions a pulse wave may not appear at the wrist as a result of every ventricular contraction. Dehio, of Dorpat, has proposed the use of atropine as a means of differentiating brachycardia from irritation of the pneumogastric from cases dependent upon a lesion of the automatic motor apparatus of the heart. This drug paralyzes the motor nerve endings of the vagus in the heart. Consequently, in those cases of brachycardia caused by irritation of the bulbar vagus centre of the terminations of the nerves in the heart, atropine administered hypodermatically will cause the pulse to rise in frequency.

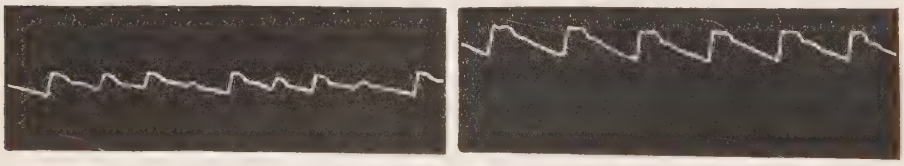
Prognosis.—The prognostic significance of a brachycardia depends upon the cause. When associated with degenerative changes in the myocardium and aorta, or with central nervous affections, the prognosis is especially unfavorable.

ARRHYTHMICAL DISTURBANCES OF THE HEART.

Disturbance of the cardiac rhythm is not an unusual symptom of both functional and organic affections of the heart. Such a departure

from the normal easy rhythmical action of the heart is designated arrhythmia. Irregularity in volume may occur, as well as in time. Irregularity of this character is not always, however, of pathological importance, as there are persons who present this symptom even for years, and yet whose hearts appear perfectly normal. In such individuals the cause of the abnormality is evidently neurotic. In some it is a constitutional idiosyncrasy, and cannot be related even to demonstrable nervous causes. It cannot, therefore, be always considered as a symptom of serious import. Such influences as excessive emotion, anxiety, fright, pain, indigestion and prostration may excite it through their influence upon the general nervous apparatus. It may occur in association with diseases of the brain, stomach, liver, kidneys, and with gout, rheumatism, and various diathetic conditions. Most important are the various organic heart lesions which lead to enfeeblement. In all cases a careful exploration should be made, and if the impulse is weak and evidences of structural alterations are to be had, the condition is one of gravity.

It is necessary to define certain varieties of arrhythmia, some of which have but recently been described in medical literature. The word *inter-*

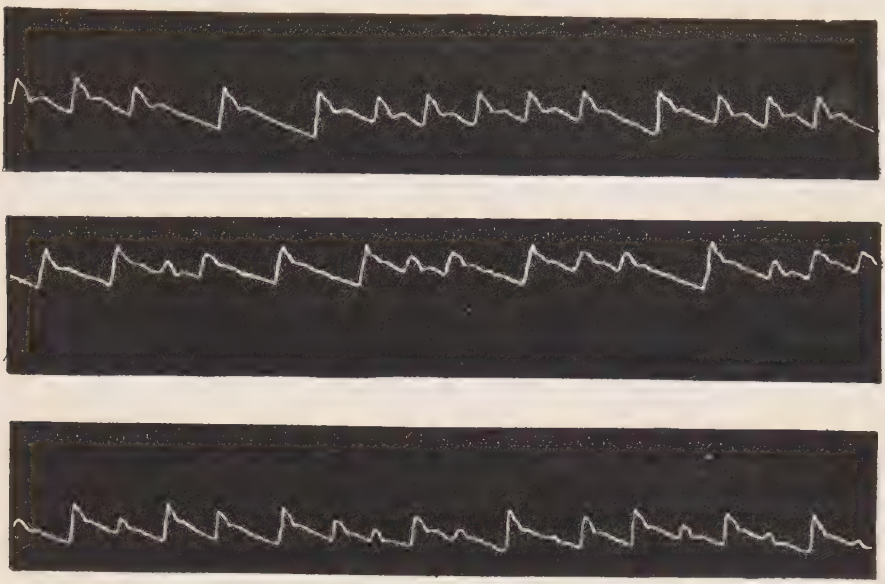


a *b*

FIG. 13.—*a*. ARRHYTHEMIA. *b*. SAME PULSE THREE DAYS LATER, AFTER TAKING STROPHANTHUS AND GLONOIN.

mission has been generally applied to the dropping of a pulse beat. Such a loss of a pulse wave at the wrist may or may not be attended by an absence of the ventricular contraction. If absent, the word *deficience* is then of more correct application. The disparity sometimes existing between the heart-beats counted in the radial artery and at the apex, is due to a feeble ventricle which is not capable at every contraction of filling the arteries sufficiently to excite an appreciable expansion or pulse. *Embryocardia* or *fœtal rhythm* is a term applied by Huchard to a condition represented by a shortening of the "long pause" and by identical character of the two sounds of the heart. The heart's action is then compared to the ticking of a watch or to the action of the fœtal heart. It is a condition dependent upon serious forms of disease, *i. e.*, dilated heart, the late stages of Graves' disease, and various protracted febrile conditions such as typhoid fever. An excessively rapid heart action from any cause may resemble embryocardia, but it is claimed by many observers that the two sounds of the heart may be distinguished, even with a rate as high as two hundred per minute. This assertion appears to me as of doubt-

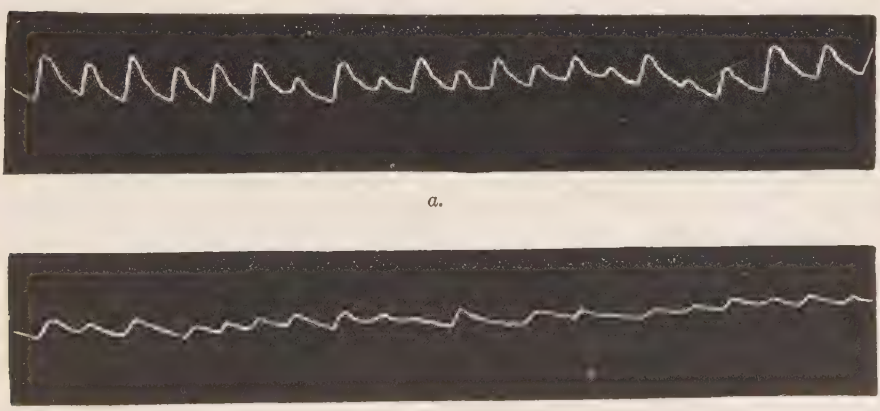
ful truth. Embryocardia indicates a high grade of cardiac weakness and loss of arterial tension. Sansom rather suggests its dependence



FIGS. 14, 15 AND 16.—EXAMPLES OF ARRHYTHEMIA.

upon myocarditis. The significance of this symptom is of the worst possible character. It warrants the gravest prognosis.

Pulsus paradoxicus. Kussmaul described this peculiar weakening of



a.

b.

FIG. 17.—IRREGULAR PULSE IN CASE OF EXTENSIVE VALVULAR AND MYOCARDIAL DISEASE IN PATIENT WITH SENILE GANGRENE. *a.* TWO DAYS BEFORE DEATH. *b.* EVENING BEFORE DEATH.

the pulse, even to extinction, during inspiratory efforts. It is associated with pericarditis during the stage of effusion. At one time it was sup-

posed to indicate pericarditis with the development of fibrous material at the base of the heart about the large vessels, but further observation has shown it to be associated with many pathological conditions. It may be observed as a physiological state.

"*Cantering*" or "*gallop rhythm*," so named on account of the resemblance of the rhythm of the heart sounds to the footfalls of a cantering horse, is characterized by a splitting of the first or more frequently of the second sound. The time of appearance of this supplemental sound differs. It may follow the second or precede the first sound, being separated from either by a very short interval. Another feature is the change of relationship to the heart sounds which may take place, *i. e.*, it does not always retain a fixed relationship to the normal sounds in any given case. The condition does not differ from what is commonly described as "reduplication" of heart sounds. Like most disturbances of rhythm it may be found in perfectly healthy persons. In its typical form it attends upon profound anæmia, cases of Bright's disease associated with arterio-sclerosis, dilatation of the heart, myocardial degeneration during the acute infectious diseases, and especially, typhoid fever. It is always distinguishable in its greatest intensity at the apex. Potain, who studied this rhythmical disorder with care, states that the sound is diastolic and produced by the tension of the ventricular wall resulting from the filling of that chamber. The lessened extensibility of the ventricle incident to hypertrophy, as seen, for instance, in Bright's disease, or to exhausted muscular tone, leads to a more ready response to intraventricular tension. This peculiar rhythm is heard in cases in which the "elastic resistance of the ventricular wall is in excess of its muscular tonicity." The gallop rhythm is of grave import, especially in chronic Bright's disease.

The *bi-* or *trigeminal rhythm* is the separation of the heart-beats into groups of two or three. The first beat after the long pause is usually stronger than the succeeding ones. It is found in many affections of the heart, especially in mitral disease. Rarely, an alternation of ventricular contractions of different degrees of intensity results in alternate strong and weak pulses.

Delirium cordis is applied to a condition of extreme irregularity in which a variety of rhythmical disturbances of the heart's action is manifested.

Treatment.—Bradycardia and arrhythmia being symptoms dependent upon a variety of pathological conditions, but little can be said of their treatment *per se*. In each case the primary disease must be studied and the therapeutic measures applied accordingly.

EXOPHTHALMIC GOITRE.

Synonyms.—Basedow's disease; Graves' disease; tachycardia vasomotoria; Flajani's disease.

Definition.—A disease of uncertain pathology, characterized clinically by goitre, exophthalmos, and rapid cardiac action.

Etiology.—Until the pathology of exophthalmic goitre has been determined positively, the etiology of the disease must remain in obscurity. Certain factors apparently bear a causative relation in individual cases, but the part they play in the production of this affection is unknown. No age is exempt from the disease excepting that of infancy. The majority of cases are observed in subjects between the ages of twenty and thirty years. The occurrence of exophthalmic goitre in children is occasionally noted. Women are far more frequently affected than are men, probably in the proportion of six to one. This is undoubtedly due to the neurotic habit of females, for it has been observed that nervous influences are frequently assigned as the origin of the malady. Thus, cases have arisen from depressing emotions and fright, grief, anger, worry, and ovarian disease. Heredity seems to play but an unimportant part, if we except the transmission of a neuropathic constitution. Depressing physical agencies acting on such subjects, notably anæmia and exhausting discharges, have accounted for some cases. Pepper attaches considerable importance to the influence of marked gastro-intestinal catarrh. Of late years the theory that exophthalmic goitre is the result of overactivity of the thyroid gland has been promulgated, and has had ardent advocates in Johnston and Murray of England.

Pathology and Morbid Anatomy.—So far no morbid changes that can be regarded as pathognomonic have been discovered post-mortem. The enlargement of the thyroid gland is regarded as the most important sign, but even this presents no regularity as to its degree. Section of the gland shows that it is the vascular tissues that are mainly affected. The bloodvessels are generally enlarged; indeed they have been described as cavernous.

The cause of the exophthalmos has not been positively determined. Different authorities have attributed it to increased vascularity of the tissues behind the eyeball, post-ocular œdema, and to contraction of the involuntary muscular fibres attached to the intraorbital membrane which covers the spheno-maxillary fissure.

The cardiac symptoms have been explained by a supposed lesion of the sympathetic nervous system. The theory that exophthalmic goitre is a disease of the sympathetic nervous system still remains the most popular. In its favor is the fact that pathologists have found various changes therein, but these have not been sufficiently frequent to make their relation to the disease certain. Lesions in the medulla have been observed, but these likewise are inconstant. Hale White reports one case in which he observed hæmorrhages in the floor of the fourth ventricle. Filehne produced the disease experimentally by division of the restiform bodies. Johnston and Murray have plead for a thyroid origin for the

disease, basing their opinion on the marked symptomatic contrast between exophthalmic goitre and myxœdema, the latter having been positively determined to be the result of deficient or absent thyroid secretion.

Symptomatology.—The symptoms of exophthalmic goitre are nearly always of gradual onset. Exceptionally, however, acute cases have been observed, the most notable of which is that reported by Lloyd in which rapid cardiac action came on suddenly, and the patient died in three days' time. As already stated, the cardinal symptoms of the malady are the goitre, the exophthalmos, and the rapid cardiac action. Any one of these may constitute the first evidence of disease. Obtrusive as these symptoms should appear, they often escape notice, the patient seeking treatment in order to be relieved of an unusual weakness or unnatural nervousness. It is said, we can have exophthalmic goitre without the exophthalmos; *i. e.*, only the goitre and the rapid heart action being noted. Cases are reported too, in which the rapid cardiac action and the exophthalmos are present, but not the goitre.

The goitre is always of gradual onset. The enlargement involves all portions of the gland, often, however, one side more than the other. It has been observed as a matter of some interest that the exophthalmos is usually more marked on the side corresponding to the greatest thyroid enlargement. The goitre varies in size from day to day, and is generally the most pronounced when the cardiac symptoms are most prominent. Palpation of the tumor reveals a well-marked pulsation and not infrequently a distinct thrill, which is synchronous with the heart beats. Stethoscopic examination discloses a blowing murmur, which Guttman regards as absolutely pathognomonic of exophthalmic goitre, for he has found it present in all cases, and as regularly absent in enlarged thyroid from any other cause. It occurs independently of any cardiac murmur, and is due to the irregular dilatation of the arteries of the gland itself. In very many cases, the goitre is so small as to be recognized only when a special search is made for it.

The exophthalmos is the symptom which appeals most prominently to the friends of the patient. Like the goitre, it varies from day to day. Both eyes are affected, one sometimes more than the other. Ordinarily the protrusion of the eyeballs is not very great. Exceptionally it assumes such a high grade that the lids are unable to close over the balls and destruction of the organ of vision follows. In still more extreme cases the ball is extruded from the orbit. This exophthalmos presents certain important features separating it from prominent eyeballs arising from other causes. First of these is von Graefe's sign. When the patient is directed to look downward, it is observed that the upper eyelid does not drop in proportion to the downward excursion of the eye, and a more or less marked line of sclerotic is seen between the palpebral edge and the margin of the cornea. By many this symptom is

regarded as pathognomonic, incorrectly however. It is occasionally absent in cases of exophthalmic goitre and according to Sharkey is occasionally encountered as a symptom of other conditions. Stellwag observed that in many cases the normal winking movements of the eyelids are restrained, and Mobius called attention to a diminution in the power of convergence. Pupillary disturbances are sometimes observed. Usually the pupils are found dilated and reacting normally to light. Sometimes they are unequal. Donders observed that a vascular murmur, resembling the placental bruit, could be heard by the aid of the stethoscope in the orbit. The cornea is sometimes more or less insensitive, owing probably to insufficient lubrication with the tears. The ophthalmoscope shows pulsation of the retinal arteries.

The circulatory symptoms are generally the ones which direct the patient's attention to the necessity of seeking treatment. Some physicians say that they may constitute the only phenomena of some cases. Others assert that the failure to observe an associated goitre is the result of deficient powers of observation. The most prominent circulatory symptom is violent attacks of palpitation during which the heart beats rapidly and forcibly. In marked cases the pulse-rate may reach as high as 180 per minute. In the early stages the apex beat is found at the normal point; but with long continuance of the disease, dilatation of the heart ensues, and with it all the grave phenomena of that condition. Auscultation reveals the presence of a soft systolic murmur at the base of the heart. The pulsations in many of the arteries are visible. Sometimes murmurs are heard over the jugular veins. Pulsations of the abdominal aorta are sometimes visible.

Besides the cardinal symptoms of exophthalmic goitre, other clinical phenomena are noted with sufficient constancy to make them important parts of the symptomatic picture. One of these is tremor. This is almost invariably present. It consists of a very fine tremulous movement, aggravated under any excitement. In some cases it is so slight as to be observed only when attention is directed to it. In others, it constitutes the main source of annoyance. Some say it may be coarse and jerky in character, but I have never observed the tremor having such character.

In women menstrual disturbances are nearly alway present, the patient passing month after month without the accustomed flow asserting itself.

Very many cases have local or general œdema as a symptom. This phenomenon is observed more particularly about the eyes. Abdominal dropsy sometimes occurs, and in association with the amenorrhœa, may give rise to unjust suspicions. The œdema is offered as the explanation of a symptom of exophthalmic goitre to which attention was first called by Charcot, namely, diminished electrical resistance of the body, a symp-

tom which appears to be one of diagnostic interest rather than one of great practical value, for usually the case can be recognized without resort to the battery.

The chest expansion is deficient, a symptom first described as belonging to this disease by Bryson.

This symptom, regarded by Bryson as pathognomonic, has been quite recently exploded by extensive experiments, which tend to prove that the diminished chest expansion is simply a part of a general muscular weakness. Other muscles show proportionate weakness in exophthalmos.

Some patients complain of morbid sensations of heat and flushing and local and general sweatings brought on by slight exertions or emotions. Owing to the neurotic habit of the patient almost any of the symptoms observed in neurasthenia occur, and may indeed prove one of the main sources of annoyance.

Diagnosis.—Sufficient has already been said to suggest the diagnostic difficulties surrounding the recognition of exophthalmic goitre. Every case of tachycardia should be thoroughly examined lest a slight exophthalmos or goitre escape observation. An ordinary parenchymatous goitre, if of large size, may by pressure on the nerves of the neck produce cardiac disturbances which will suggest the possibility of the case being one of exophthalmic goitre.

Prognosis.—The prognosis of this disease is ordinarily held to be unfavorable, but few cases recovering. This is probably true when treatment has been neglected until the heart has undergone dilatation. Under any circumstances the disease pursues a chronic course, several years elapsing before even an approximate cure is obtained. Recourse to the measures about to be recommended will most assuredly bring about far better results than those claimed by Pepper, namely 20 to 25 per cent. of recoveries.

Treatment.—Probably the most important element in the treatment of exophthalmic goitre is rest. How nearly complete it should be in individual cases, the physician's judgment only can decide. When the temperament of the patient will permit of it, absolute rest in bed for many weeks will prove best. When, however, the enforced idleness causes the patient's mind to dwell altogether too much on the ailment, modifications of the rest treatment are necessary. In no case is it safe for the patient to go about his or her duties regardless of the illness. It is really remarkable to note the wonderful influence absolute rest has upon the pulse-rate and the general symptoms giving rise to discomfort.

The diet of these patients should be nutritious. Eggs, milk, meat and other nutritious articles are relied on. Schnaubert recommends a diet of skimmed milk, and reports successful cases treated by this measure. The chronicity of the complaint necessarily makes such a

treatment decidedly irksome. Moreover, there is really but little to be gained from it, when the patient can take ordinary good food with relish and without disordering digestion.

If the patient is kept at absolute rest, general nutrition and digestion will be greatly aided by the daily employment of general massage.

Moral treatment is all important, as it is in all neurotic affections. Emotional influences must be removed as much as possible. Sight must not be lost of the fact that the disease may originate in fright, grief or other agencies exerting a depressing influence. Many times it may prove advisable to send the patient away from home, always, however, to a quiet place.

Hydrotherapy finds a place of some importance in the therapeutics of this disease. Cold sponge baths each morning followed by brisk friction are invaluable. Dana, however, advises tepid bathing and the daily use of the spinal ice-bag. Nothnagel and others strongly recommend the application of cold over the region of the heart as the most efficient agent against the dyspnœa which occasionally becomes a source of great suffering. Gowers advises for the same symptom, derivatives, as "hip baths," and mustard plasters to the feet, with cold to the thyroid (if its enlargement is sufficient to be a cause of dyspnœa).

The general impression concerning the influence of pregnancy on patients with exophthalmic goitre is that the latter disease is favorably influenced thereby. Some French physicians have even advised pregnancy as a means of treatment. Hutchinson says that the disease never occurs during pregnancy. Habershon, however, reports a case in which pregnancy apparently excited the disease.

The removal of nasal hypertrophies has acted curatively in a few cases. Hack reports a case of exophthalmic goitre in a mouth breather. He cauterized the mucus membrane of one nasal cavity. On the following day the exophthalmos on the corresponding side had greatly diminished. The operation was then repeated on the opposite side, with equally favorable result. The case was thus cured. Massholder has cured one case by the treatment of nasal hypertrophy.

Electricity is a valuable adjuvant. The methods of application vary greatly, according to the operator. The best results are to be obtained by the method recommended by Rockwell. He places the "cathode over the cilio-spinal centre above the seventh cervical vertebræ, and the anode in the auriculo-maxillary fossa, gradually drawing the latter (after a few minutes of stabile treatment) along the inner border of the sterno-cleido muscle to its lower extremity. The second step in this process consists in removing the anode to the position occupied by the cathode and placing the latter over the solar plexus, using for a minute or so longer a greatly increased strength of current. In one case, failing, after considerable effort, to accomplish more than a very moderate degree of amelioration,

he made use of currents that were rapidly increased every few seconds with considerable benefit." While this treatment is the one we usually employ, others are recommended by competent authority, and for the sake of completeness deserve mention. Leslie Phillips cured one case by one sub-aural galvanization, using a current of seven milliamperes for ten minutes daily. Suckling prefers galvanization of the cervical sympathetic. Vigoureux believes in faradism, and lays down the following explicit directions: (1) A large electrode from 7 to 8 c. m. in diameter is applied to the inferior part of the neck posteriorly, and is held in position by means of a band. The other electrode is olive-shaped or button-shaped, and less than 1 c. m. in diameter, and is connected with the positive pole of the battery. This electrode is applied behind the angle of the jaw in front of the sterno-mastoid muscle, and is made to press upon the carotid artery. The application is made during a minute and a half, and is then transferred to the opposite side, where it is continued for the same length of time. (2) The small electrode is then passed lightly over both orbiculares palpebrarum in turn. (3) The olive electrode is now replaced by a plate 4 c. m. in diameter, and is applied to the thyroid tumor. (4) The next electrode is now rendered positive and is applied to the præcordial space in the third intercostal space to the left of the sternum, and the current should be sufficiently strong just to excite fibrillary contractions. The application is made for two or three minutes. The seances are repeated every second day. Cardew describes a treatment which he leaves to the patient's attendants. He gives his principles in a few words, as follows: (1) Galvanism is superior to faradism. (2) Very weak current strength (two to three milliamperes) is sufficient. (3) Each application should last six minutes. Frequent applications (three times a day) should be made. (4) The anode should be placed over the nape of the neck, the centre of its lower border corresponding to the seventh cervical spinous process, and be held firmly in that position during the application. The cathode should then be moved up and down the side of the neck from the mastoid process along the course of the great nerves. The cases reported by Cardew show conclusively the value of his method, which, after all, is but a modification of that of Rockwell simplified for lay administration of the current.

As to medicines, digitalis, iodide of potassium, and most of the remedies recommended by the old school are absolutely inefficient. *Lycopus* will probably be found to be the most efficient medicine in the majority of cases. It is best administered in the mother tincture, five-drop doses being given every three hours. Under its use the heart action is often quieted, and the general condition of the patient improves. This remedy was first recommended by Hale many years ago, and was highly praised by Lilienthal.

From a symptomatic standpoint many cases will call for *sulphur*, which will often alleviate the symptoms for which it is given.

For the violent palpitations with congestions, *aurum* is a good remedy, especially if mental depression is a prominent feature of the case. *Nitrite of amyl, glonoin* and *pilocarpin* are adapted to the morbid flushings and sweatings. *Iodine* is suited to cases in which goitre is well marked, and the heart has undergone hypertrophy. The patient is irritable and nervous; vertigo, cerebral congestions, hysterical manifestations, epistaxis, excessive hunger, emaciation, tremor, fainting and debility are additional indications for its use. *Belladonna, ferrum, arsenicum, baryta carb.*, the *calcareas*, and *conium* may be called for by the symptoms of individual cases.

ANGINA PECTORIS.

Definition.—The term angina pectoris is properly applied to an affection of the heart, the most important features of which are paroxysms of violent pain in the cardiac region with extension of the same to various neighboring localities, oppression of the chest and fear of impending death. At the same time it must be borne in mind that angina pectoris may be symptomatic of quite a variety of morbid affections of the heart and its vessels, especially those in which changes in the root of the aorta and coronary arteries are marked.

Etiology and Morbid Anatomy.—Angina pectoris was first described by Heberden, in 1796, by whom it was given the name of breast pang. Since his day it has been carefully investigated by numerous clinicians, and yet it can hardly be said that we at the present time are at all conversant with its etiology and pathology. Quite a variety of synonyms based on hypotheses as to the causes of the disease have been employed, *e. g.*, stenocardia and neuralgia of the heart, but these are now obsolete.

As already intimated, there is still a considerable diversity of opinion as to the essential character of angina pectoris. One theory claims that it is due to *spasm of the heart muscle*, and the pain therefore of muscular origin; but this idea seems to be negatived by the regularity of the heart's action during an attack, as well as by the absence of any post-mortem evidence of such a condition of spasm. Another theory, the *neurosal*, is almost equally open to objection, the majority of cases of angina pectoris occurring in men, while neurotic troubles are of far more frequent occurrence in women. A *vaso-motor* form of angina pectoris has been described by Nothnagel. This author attributes the pain to tension of the ventricular walls induced by a general vascular spasm. The contraction of the peripheral arteries leads to a sense of stiffness, cyanosis marked even in the extremities, and low temperature. While the existence of cases of this character is possible, and many of their prominent features are also characteristic of typical angina, they must be regarded as of rare occurrence. The most recent view, to the

effect that angina pectoris is the result of a *neuritis* involving the cardiac plexus, has much to support it. Traube, supporting the opinion that the paroxysms are due to extreme tension of the ventricular walls in consequence of an acute dilatation, and usually associated with a disease of the coronary arteries, held that the pain resulted from the stretching and tension of the nerves in the muscular substance.

An enumeration of the pathological conditions associated with paroxysms of angina would represent the entire morbid anatomy of the heart. The most frequently encountered lesions are those of the coronary arteries, arterio-sclerosis, fatty degeneration of the heart (a condition often associated with diseased coronary arteries), valvular disease of the heart (especially aortic incompetence), aneurism, and lesions of the aorta.

A consensus of the most recent opinions respecting the pathology of angina pectoris seems to locate the disease in the ganglionic system of the heart. The cardiac plexus located behind and below the aortic arch, and which sends filaments to the coronary arteries, is considered as of especial importance in this connection. The localization of the disease at this point accounts for the frequent association of angina pectoris with disease of the coronary arteries and aorta. Then again, the cardiac plexus is composed of fibres from both the sympathetic system and the vagus, and thus becomes intimately associated with various neighboring nerve tracts; this readily explains the numerous localities into which the pain radiates. Marked lesions of the nervous apparatus of the heart have not as yet been reported frequently enough to make it clear that angina pectoris is due to anatomical changes in these structures, but many observers have reported congestions, proliferated connective tissue, infiltrations of the connective tissue with white corpuscles, in fact the evidences of a neuritis. Pressure by enlarged glands is not a rare feature. Beginning degeneration of nerve fibres, and granular and pigmentary degeneration of the ganglionic cells of the septum between the auricles, were observed by Putjakin.

According to Peter the old but recently revived theory that angina pectoris is due to an obstructive lesion of the coronary arteries, or in the absence of such lesion to spasm of the coronaries, is founded upon erroneous observations, usually, to the overlooking of an aortitis or periaortitis.

Gout, and all that that term implies, *i. e.*, heredity, high living, and sedentary habits, are credited by all authorities as possessing an important etiological relationship to angina pectoris. Rheumatism does not seem to be a very important etiological factor, for Sutton states that he has never met a case of angina with rheumatic changes in the valves.

Age and sex undoubtedly are important predisposing factors, for the disease is very rare in women, nor is it likely to occur prior to the forty-fifth year.

Paroxysms seem to be excited by cold, violent exertion, and mental excitement. Some observers think they are apt to occur when patients are falling asleep. Still they may appear at any time, and may even arouse the patient from sleep. Sometimes angina pectoris occurs in conjunction with hysteria, epilepsy, and various affections of the nervous system, and following certain excesses, as overindulgence in alcohol and tobacco.

Reverting to the relationship of angina pectoris and gout, one is reminded of the doctrines of Haig. This author, possibly, is inclined to attribute too much importance to the uric acid diathesis as a disease-producing factor; at the same time, one must acknowledge that his views are very appropriate in a certain line of cases. The influence of uric acid in the causation of angina, independently of the existence of actual gouty lesions, is probably considerable. Haig states that other things being the same, arterial tension varies with the amount of uric acid circulating in the blood. He contends that a great number of observations demonstrates that an increase in the alkalinity of the blood leads to an increase in the amount of uric acid, attended by slow pulse, increased arterial tension, diminished urine and relief of joint pains; but produces a slow circulation in the brain, languor, depression of spirits, and, perhaps, a headache or convulsion. *Per contra*, decrease in alkalinity lessens the uric acid in the blood, diminishes arterial tension, develops pains in the joints, relieves headaches, and encourages a happier mental state. He also further states that the highest state of acidity is reached about the middle of the night—from that time until noon—which accounts for the occurrence of many affections dependent largely upon the uric acid diathesis, in the early part of the day.

The outcome of a consideration of the relationship of angina pectoris to morbid changes in the heart suggests that it is a group of symptoms which may often appear independently of a demonstrable heart lesion, although the number of cases of this character must necessarily diminish with the adoption of more painstaking investigations into the minute anatomy of the cardiac tissues. In this class of cases, there is, therefore, no evidence of any organic defect. Notwithstanding this, attacks may be frequent and may terminate life.

A second group of cases presents, even during life, full evidences of structural disease of the heart of a most varied character. It should be borne in mind, on the other hand, that every one of these structural changes may be observed without a clinical history of paroxysmal pain. We must therefore conclude with Sutton, as even minute lesions cannot be demonstrated in some instances, "that not in gross structural changes, but in the nervous working of the heart, lies the cause of angina pectoris."

Symptoms.—The rarity of typical angina and the absence of premonitions of an oncoming attack, as well as the usually short duration of the paroxysms, renders it a disease seldom witnessed by the physician. As already intimated, attacks are more apt to appear during exercise, or from some variety of mental emotion. The onset then may be either sudden, or warning symptoms may precede the pain. The first and most important symptom is pain of a peculiar character, which is referred by the patient to the præcordium, and is accompanied by a sense of constriction. The characteristics of this pain are graphically described by the patients, most of whom consider it as unlike any other kind of pain. The focus of greatest intensity is stated by Sansom to be most frequently in the region of the arch of the aorta, and by Eichhorst, to be beneath the lower portion of the sternum and the region of the left nipple. The pain may involve the whole chest, as in a remarkable case seen by me. More frequently, however, it radiates into the area of distribution of the brachial plexus, especially the left, as indicated by pain about the shoulder and in the arm. An epigastric focus is not uncommon. Extension may also occur into the neck, "even into the throat," the abdomen, and the testicles; indeed there is scarcely a region of the body to which the pain has not been reported as extending. If the patient is walking at the time of the onset of an attack, the pain generally brings him to a halt; he is apt to seize some object as if for support and the pale countenance presents an appearance of extreme distress or anguish. There may be a horrible sense of suffocation and immobility of the chest. The eyes may appear staring or fixed, and the face or entire body may be bathed in a clammy sweat. Vomiting may occur. The pulse is generally altered, for with the progress of the attack, circulatory failure is often apparent. With the beginning of a paroxysm, tension of the pulse is increased, but as the condition progresses, it soon becomes sub-normal. The rhythm of the pulse is often undisturbed and slow. Various authors hold diverse views as to the condition of the pulse. According to Brunton, who has made extremely valuable observations in this connection, there is often a pulse of sustained high tension. Broadbent makes the pulse variable in character. It may be slow, show high tension, be weak or irregular, or again totally unaffected. It must be borne in mind, however, that any existing heart affections must impress their individuality on the pulse.

Dyspnœa may be present or absent, more frequently the latter.

The duration of a paroxysm varies from a few seconds to two or three minutes, even to ten or fifteen minutes in exceptional cases. Eichhorst says that paroxysms may even last for several hours. With relief of the paroxysm may come vomiting, eructations of gas, or the passage of large quantities of urine of low specific gravity. The usual condition of health is recovered within a few hours or days, according to the sever-

ity of the attack and the general condition of the patient. The severity of individual paroxysms presents the greatest variations. While the suffering is often extreme, still typical cases occur in which all the symptoms are of very mild intensity.

Attempts have been made to recognize a variety of forms of angina, but our knowledge does not yet appear sufficiently ripe to permit of any such classification.

Diagnosis.—A paroxysm of angina pectoris is usually easy of recognition. Sometimes a difficulty in diagnosis is encountered by the very close simulation of the disease by the hysterical variety. In the latter form the symptoms are usually developed in women of an age which is strongly opposed to true angina. Such persons are of a neurotic character, and the attacks often appear with a regularity not common to the true form. The long continuance of the attack, which is accompanied by restless excitement, suggests the pseudo variety.

When the paroxysm has subsided a most thorough examination of all the organs should be made and any disorder of function corrected as far as may be possible. If a lesion in the heart or its environs is present, it is important, if possible, to ascertain its exact character.

A variety of conditions resemble true angina pectoris. Trousseau described epileptiform neuralgia, an affection represented by severe chest pain and distressing dyspnœa, followed by unconsciousness. It may result in death. The attack is preceded by a warning symptom analagous to the epileptic aura. If recovery from the attack takes place, stigmata or vibices similar to those sometimes seen after an epileptic fit may be observed upon various portions of the body.

Various neuralgiæ, especially gastralgia, pleurodynia, and cardialgia, may simulate angina. The subjects of these troubles are apt to be hysterical or hypochondriacal, dyspeptic and anæmic. They can hardly be mistaken for angina pectoris by a careful observer. Asthmatic attacks of a sort sometimes observed in association with heart lesions marked by difficult breathing, pain in the præcordial region, sudden onset, and sudden cessation, present a greater similarity than the preceding.

Prognosis.—A small percentage of cases of angina recover entirely. As to individual attacks and their danger, but little that is positive and dogmatic can be said. First seizures are sometimes fatal; the second or third often so, especially if separated by a considerable interval of time. Many patients survive a large number of paroxysms occurring over many years. Osler's statement that "Cardiac pain without evidence of arterio-sclerosis or valve disease is not of much moment" is negatived by a case seen at the Hahnemann Hospital, in which most violent attacks were repeatedly observed in a man of forty-seven years of age, without the slightest evidence of disease of the cardio-vascular system. When such lesions exist, the prognosis is much more grave, and will be governed

largely by the nature and gravity of the underlying lesion. The prognosis of symptomatic angina is most unfavorable. Many cases defy treatment. Even control of the pain may require larger and larger doses of narcotics to afford comparative relief.

Treatment.—In the management of angina pectoris the general health is usually too much neglected, altogether too much attention being paid to the cardiac symptoms. Everything calculated to improve general nutrition must be considered. Diathetic conditions must be antagonized. Moderation in mental and physical exertion must be enjoined. Walking against the wind, ascending stairs and hills, and any violent exercise, especially if conjoined with mental excitement, may excite an attack, and should therefore be interdicted. The meals should be small and frequent, and adapted to the nutritive state of the patient. During the attack we have nothing to offer better than the inhalation of *amyl nitrite*, a few drops of which may be inhaled from a handkerchief. This remedy is especially indicated if vascular tension is increased. Perles containing a proper amount for single inhalations are procurable and should be carried by persons subject to these attacks. They should be used promptly on the appearance of the first symptom. *Nitro-glycerin* and *nitrite of sodium* are also recommended, but are much slower in action, and there is no evidence with which I am acquainted, that either drug succeeds when nitrite of amyl fails. *Chloroform* has been recommended and much used. Many think *ether* preferable, especially if the heart is weak. One of these articles should be inhaled if relief from the amyl nitrite is not prompt and satisfactory. A very small quantity will usually suffice.

From the symptoms observed in the inter-paroxysmal period will be gathered the indications for preventive treatment. The medicine which has enjoyed the greatest reputation with all practitioners is *arsenic*. Those who give infinitesimal doses, as well as those who give large ones of Fowler's solution, have been equally laudatory. A large number of symptoms suggestive of this medicine will be discovered in the materia medica.

Iodide of potassium has of late been very much employed by the old school. It is favored by those advocating neuritis as the cause of angina pectoris. A medicine I am able to speak encouragingly of is the *chloride of gold*, in the second decimal trituration. Given for a considerable period of time, I have found it valuable. Its value as a remedy in arterio-sclerosis and neuritis suggests its line of action.

Jousset commends *spigelia* as the most important medicine. "The substernal pain radiating to the arms and neck, with anguish, palpitation, irregular pulse and tendency to syncope," strongly suggest it. I have thus far found this remedy of most use in the pseudo angina pectoris.

Nux vomica has also been commended by Jousset for gouty and hæmorrhoidal individuals.

Bähr reported a cure from *digitalis.*

Lilium and *cactus* have both been used with satisfaction, being prescribed mainly upon the constriction symptom common to both.

Aconitine suggested by Hughes, I have found helpful in pseudo-angina. It appears strongly indicated in some cases of this kind.

Naja was reported by Bradshaw as proving curative in a well-marked case.

Some patients, according to Eichhorst, are relieved by swallowing pieces of ice, or by the application of an ice bag to the cardiac region.

Peter claims remarkable result from the use of iodide of potassium and the application of the actual cautery to the third intercostal spaces near the sternum, especially upon the left side. During the attack he prefers *muriate of morphine* to nitro-glycerin. He thinks this treatment best combats the peri-neuritis and the peri-aortitis.

Huchard's treatment with large doses of the *iodides* has been favorably reported upon. Schley, of New York, has used the *iodide of sodium* in doses ranging from five to twenty grains daily, in six cases of angina pectoris dependent upon organic disease of the heart, and reports most excellent results. Of late the *iodide of strontium* has come into favor and seems better adapted to the treatment of cardiac and vascular diseases than any of the other iodides.

Electricity has given me valuable aid. I have followed the advice of Eulenberg, who recommends the application of the anode to the sternum and cathode to the lower cervical spine. Faradism has proven valuable in the pseudo-angina, one pole being applied to the upper spine, the other freely over the cardiac region. General faradization is also of value in these cases.

Congenital Affections of the Heart.

The heart, in rare instances, is defective at birth, the pathological condition having been produced by endocarditis during fœtal life, or by developmental errors. The latter cases may be grouped into two varieties, one in which there is a persistence after birth of conditions normal to intra-uterine life, and the other, imperfect development of the heart.

Fœtal endocarditis is probably not as common an affection as ordinarily held, for there are pathological changes which may be readily confounded with it. Thus, there may occasionally be observed on the valves small round bodies, usually of a deep purple color, which are erroneously regarded as endocardial outgrowths, but, in reality, are minute hæmorrhages. Then again, the nodules of Albini, structures belonging to fœtal life, sometimes persist, and are found on the auriculoventricular valves, and are mistaken for endocardial vegetations. Endocarditis in the fœtus is found with greater frequency on the right side of the heart than on the left, because that is the side of the organ which bears the greatest strain in sustaining the circulation, according to some pathologists, or because of the valves of the right heart being more frequently the seat of congenital developmental anomalies, according to others.

The developmental cardiac anomalies are quite varied, the departures from the normal being found in the heart substance, in the septum, in the valves, or in all three.

Abnormal position of the heart has been observed. One of the most interesting of these is "*dextrocardia*," a condition in which the heart occupies a position in the right side of the thorax. Such cases are always attended by complete transposition of all the viscera. Sometimes the heart occupies the median line—*mesocardia.* This is a normal condition in the fœtus. When found in the adult, it is nearly always associated with some other abnormality.

Acardia, or absence of the heart, has been observed.

Double heart has only been found in the lower animals, and is then associated with other deformities of extreme degree.

Bifid apex is sometimes seen. The changes are observed on the outer surface of the heart. The term is self-explanatory. The bifid apex is the only defect.

Ectopia cordis is a condition in which, by reason of defective development of the chest wall, the heart lies free immediately beneath the

skin. It may occupy one of three different positions: It may be situated in the neck, in which case it may be in contact with almost any of the structures normal to that locality; it may occupy its normal position, but the bony coverings of the thorax over it are absent; or lastly it may lie below the diaphragm. These cases of ectopia cordis are usually still-born. Some few cases, in which life has been prolonged for a number of years, have been recorded.

Developmental defects of the septum and valves are not so very uncommon. The septum may be deficient in whole or in part. There may exist anomalies of any of the valves, either regurgitant or obstructive in character.

Symptomatology.—The most important symptom of congenital disease of the heart is cyanosis. This is usually manifested immediately after birth. It is generally such a prominent phenomenon that it has led to the designation "morbus cœruleus," or "blue disease," for all these cases. When the lesion is a slight one, and does not interfere seriously with the cardiac functions, cyanosis may not be noted for several days, or it only becomes obtrusive when the child cries or in other ways throws extra work on the heart. It is apt to be especially prominent when the little one is suffering from an acute respiratory inflammation, as bronchitis or pneumonia. In many cases it persists or increases in intensity over a term of years. The general surface of the body is cold; the pulse is small and weak; there may ensue dropsy, dyspnœa, convulsions, or internal hæmorrhages.

Diagnosis.—The recognition of the character of the lesion producing the congenital cyanosis is ordinarily quite a difficult matter. In the case of valvular defects, the evidence of disease is the same as in the case of the same trouble when affecting adults.

Prognosis.—The prognosis of all cases of congenital heart disease is grave. The majority are still-born or die within a few days after birth. Exceptionally life is prolonged for years, cases of pulmonary stenosis offering the best outlook.

Treatment.—The treatment consists of attention to hygienic details, and the application of remedies according to the principles already presented in the chapter on valvular diseases of the heart.

Diseases of the Bloodvessels.

Owing probably to their not unnatural obscurity, and also to the difficulties surrounding their recognition in actual practice, diseases of the vascular system have not received from most physicians the attention which the progress of modern investigations has shown they merit. It is now recognized as a certainty that in their early stages vascular diseases give rise to many conditions hitherto regarded as obscure. More than that, the interference with local and general nutrition which their lesions occasion necessarily produces many secondary changes, most of which are of a very serious character.

ARTERIO-SCLEROSIS.

Until the pathology of all forms of arterio-sclerosis has been positively determined, the nomenclature of the subject must remain in a confused state. At present a number of morbid conditions are included under this title, most of them being classed as inflammations. Thus we recognize acute and chronic inflammation as affecting the arteries. There are also combined inflammatory and degenerative processes appearing for the most part in patients after middle life, and regarded in some degree at least as a product of senility, these constituting the condition ordinarily termed atheroma. Of the chronic inflammatory affections we distinguish one in which the lumen of the vessel is reduced or obliterated, *i. e., endarteritis obliterans;* and another in which the vessel's calibre is increased, *i. e., endarteritis deformans.* The various well-known degenerative processes appearing in other organs, viz., the fatty, lardaceous, calcareous, tubercular and malignant, may also attack the arteries. The pathological change most frequently observed in practice, however, is atheroma. It has been described by most recent authors as *arterio-sclerosis.* Considerable confusion in the use of these terms has arisen; indeed many use them interchangeably. Gull and Sutton employ arterio-sclerosis to indicate the true nature of the affection, teaching its often extensive distribution even into the most minute vessels.

When we consider the deep position of most arterial trunks, rendering them inaccessible for examination purposes, the absence in many instances of appreciable evidence of established disease of the vessels, the association of symptoms arising from the vascular lesions with those of some primary disorder, and in some instances the almost entire absence of symptoms until a serious sequence such as cerebral hæmor-

rhage appears, the clinical obscurity of arterial inflammations and degenerations is not a matter of surprise.

Etiology.—The most important point respecting the etiology of the class of cases under consideration is their frequent dependence upon the poisons of syphilis, gout, and rheumatism, and their association with Bright's diseases, lead poisoning, and advancing years. Arterio-sclerosis is at times apparently solely dependent upon the degeneration which appears with advanced life, but as it often develops at an earlier period and attains a far greater severity in some cases than in others, we are obliged to assume hereditary influences or undiscovered sources of irritation of the vascular system as present and participating as important etiological factors. Unquestionably the most important of these causes are, as already stated, the presence in the blood of the toxic elements of syphilis, gout, diabetes, rheumatism, malaria, etc. Sometimes these seem to act directly on the walls of the vessels; in other cases they excite increased arterial tension, and this by its mechanical effects produces arterio-sclerosis. The proof of mechanical obstruction as a cause of vascular degeneration is well illustrated in a case of atheroma of the pulmonary artery in which marked mitral stenosis existed, the vessels of the systemic circulation being perfectly normal. High arterial tension also becomes a cause of arterio-sclerosis in plethoric individuals who have long been addicted to excesses in eating and drinking, and have not taken much exercise. Their habits tend to venous congestions as well. Excessive physical exertion, even in young men, especially when combined with poor and insufficient food and unfavorable surroundings, produces high vascular tension, and thus becomes capable of developing sclerotic and degenerative changes in the arteries.

Pathology and Morbid Anatomy.—Arterio-sclerosis may be either local or general. When the former, the lesions may be classed as circumscribed or occurring in *plaques*. Circumscribed sclerosis affects arteries of medium calibre, remaining localized in one or more parts of the vessel. It may be either syphilitic, tubercular or embolic in origin, and nearly always ends in occlusion or in aneurismal dilatation of the vessel. The arteries surrounded by lymphatic sheaths are especially apt to be involved. The syphilitic cases are observed to attack the cerebral vessels with especial frequency. The changes begin in the external tunics of the artery. Finally the intima becomes thickened, the middle coat is compressed and atrophies, and aneurismal dilatation ensues. In other cases the thickening of the coats leads to occlusion of the vessel with necrosis of the parts deriving their blood therefrom. Tubercular arteritis also attacks the cerebral arteries by preference, infiltration of the arterial tissues with granulation tissue being revealed by the microscope. It produces few or no symptoms until occlusion or rupture occurs. Embolic arteritis is especially apt to involve the cerebral and pulmonary arteries.

Arteritis en plaques generally involves the aorta. The characteristic anatomical feature is the presence of yellowish white or grayish elevations resembling cartilage in their general appearance. They are of variable size, and are most pronounced near the orifices of the vessels given off by the aorta. These plaques are at first translucent and not very firm, but with age they become firmer and finally undergo calcification. The extent of the changes may be such that the entire aorta is transformed into a rigid brittle tube. The surfaces of some of the thickened patches may undergo ulceration, the ulcerated areas presenting a number of small thrombi. Microscopic examination shows the tunica intima to be chiefly involved. It appears double or many times thicker than normal. The normal tissue elements are enlarged (swollen), new connective tissue is formed, and round corpuscles are present in abundance in the meshes of the tissue. The more external tunics take part in the changes, but to a much less degree. The areas of thickened nodular tissue undergo fibroid changes resulting in hardened dull white patches; or the same change may be diffused. Some of these patches may undergo partial fatty degeneration, while others become entirely fatty. A high grade of fatty change may be followed by softening and the collection of a quantity of yellowish fatty debris (fat, detritus, cholestrine crystals, etc.). The term "atheromatous abscess" has been applied to these collections. Rupture of the same is followed by a discharge of their contents into the blood current, and an atheromatous ulcer is thus formed. The deposit of lime salts in the fibrous tissues (calcification) results in hardened plates of varying size. Examination of these plates with the microscope reveals at times a structure resembling bone (ossification). The middle tunic is often involved by extension; the external rarely excepting by extension from without. It has been generally taught that the initial changes begin in the outer layers of the internal coat with extension outwardly and inwardly. But Köster asserts that an infiltration of the media and the adventitia is the first step, this being followed by degene rative changes in the muscle fibres, and finally by proliferation of the sub-endothelial layer of the intima with the characteristic development already described. Many of the minute arteries of the brain undergo aneurismal dilatation, giving rise to the well-known miliary aneurisms. One of the most important results of this process is a loss of elasticity in the walls of the arteries, the consequent lessened ability to resist the blood pressure still further favoring the occurrence of aneurisms. According to Thoma aneurism is particularly apt to appear about the fortieth year. If the disease is extensive, the greater resistance to the blood current results in increase in the arterial tension and hypertrophy of the heart, In senile cases hypertrophy may be absent. Myocarditis may develop as a result of obstruction of the coronary arteries.

As will be shown in the next chapter, aneurism is a consequence of

atheromatous change. If the minute vessels are extensively involved, the thickened intima reduces their lumen sufficiently to seriously impair the blood supply, and consequently the nutrition of the tributary tissues. Further obstruction may result from the formation of thrombi upon the altered intima. Embolism may result from the separation of such embolic masses or from the washing into the circulation of atheromatous debris.

Extension to the heart results usually in aortic incompetence or stenosis.

Accessible arteries, such as the radial and the temporal, are often rigid and tortuous, and the pulse full and hard. While the deposit of lime salts in the diseased tissues gives the vessel walls a greater power of resistance, and is therefore in a measure a conservative process, the tissue nutrition is still further impaired and the roughened interior favors the development of thrombi and occlusion. In the vessels of the lower extremities especially, gangrene is a common result. Associated sclerotic changes in the kidney are quite constant. Many organs may present the same change. The consequences of arterio-sclerosis are seen to be:

(1) Diminished elasticity and resistance of the bloodvessels.

(2) Lessened capacity owing to encroachment on their lumen.

(3) Impaired tissue nutrition.

(4) Roughening of the interior of the vessels, thrombosis, and embolism.

(5) Associated sequential lesions in various organs.

Symptomatology.—The predominance of the pathological changes in one or another set of vessels, results in a variety of clinical pictures for arterio-sclerosis, these differences being dependent upon the localization of the process. That advanced changes may exist in certain vessels, and we be unable to detect them, must also be borne in mind. Objective conditions are not always reliable; for we cannot with any degree of certainty judge of the condition of the internal vessels by that of those accessible to examination, for at autopsies, atheromatous degeneration of the vessels of the brain and other internal organs has been observed when the superficial vessels were perfectly normal.

The important symptoms attendant upon arterio-sclerosis are referred to the circulatory system, the brain, and the kidneys. Considering in this order, it may be stated that, early in the course of the disease, slight substernal pains with palpitation and dyspnœa may appear. The increased peripheral resistance leads naturally to hypertrophy of the heart, which may be detected by the physical signs enumerated in a previous chapter as belonging to that condition. The apex beat is abnormally strong and displaced downward and to the left. The first sound is comparatively weak. The aortic second sound is sharply accentuated, indicating the increased tension in the systemic circulation. Still later in the case, when dilatation or myocardial degeneration has taken place,

a systolic murmur may be heard at the apex. The pulse is full, hard, and slow and the artery rigid and corrugated from calcification. In extreme cases it consists of a calcareous tube. Sphygmographic tracings of the pulse exhibit the characteristics of prolonged arterial tension. The upstroke is gradual, the summit wave broad and flattened, and the dicrotic notch diminished or absent. Palpitation is quite common and angina is a feature of many cases. The aorta may be sufficiently dilated to be recognized by physical examination, *i. e.*, by percussion dulness beneath the manubrium sterni. In some cases the transverse portion of the arch of the aorta is so elevated that it can be felt by deep pressure in the suprasternal fossa. The general symptoms relating to the circulation as developed in the head, eyes, lungs, etc., are of the same general character as those observed in cardiac hypertrophy from any cause. The same may be said of the later dilatation and of the long list of symptoms of circulatory failure which are developed in time. When there are associated changes in the coronary arteries, chronic degeneration of the myocardium with all its results may follow.

The cerebral manifestations of arterio-sclerosis are quite varied. The weakened bloodvessels may rupture under the influence of the increased blood pressure. Various degenerative changes resulting from cerebral hæmorrhage and impaired nutrition incident to the presence of atheromatous vessels with reduced lumen, thrombi, and emboli, in so delicate a tissue, are very commonly present. There may be vertigo, head pains, and tinnitus. The memory fails, the intellect is enfeebled, and softening from ischæmia is developed. Temporary hemiplegia, monoplegia, aphasia, and other suggestive evidences of permanent central trouble may occur; but complete restoration from these may take place. These interesting features have not yet received a satisfactory explanation. Arterio-sclerosis is not uncommonly associated with the various forms of sclerosis of the cerebro-spinal nervous system, *e. g.*, locomotor ataxia.

Ophthalmoscopic changes are observed in some cases, but quite infrequenlty in view of the commonness with which vascular lesions in the choroid and retina are discovered at autopsies. The walls of the vessels are surrounded by a white border; they are often thickened in places, and may even be obstructed. Sometimes yellowish fatty patches are observed. In advanced cases occlusions of vessels may be noted, or their course is marked by tortuosities and dilatations. Sometimes miliary aneurisms are seen. The effects of the vascular degeneration may be exhibited in the shape of intraocular hæmorrhages.

In many cases symptoms indicative of involvement of the kidneys are developed (senile kidney), and if the case has not been under continuous observation from the first, it may be impossible to say whether the renal lesion is primary or secondary to the arterio-sclerosis. The

quantity of urine excreted is much increased; its color is pale, and the specific gravity low. The urea elimination is greatly diminished; a small amount of albumin is occasionally present, and a few casts of the hyaline variety are observable under the microscope. Often albumin does not appear until very late in the course of the disease, probably not until the approach of a fatal issue. The left ventricle is hypertrophied. Dyspnœa and asthmatic seizures often attend.

Diagnosis.—In many cases the disease is not suspected during life, the patient perhaps having died suddenly from rupture of a cerebral bloodvessel or aneurismal pouch without sufficient previous annoyance to lead to consultation with a physician. The presence of arterio-sclerosis may be surmised if in a subject of gout, syphilis, or other affections known to favor the development of vascular diseases, hypertrophied heart, thickening of the walls of the superficial bloodvessels, increased arterial tension, accentuation of the aortic second sound, and symptoms of failing nutrition of the brain and other organs appear. Should the arteries have undergone calcification, their tortuous rigid character will be manifested. The arcus senilis may or may not be present. The vessels most accessible for examination are the radial, brachial, temporal, and femoral arteries. A peculiar spiral form of the palpated vessels is often perceptible.

When a late systolic blowing murmur develops, the condition may be mistaken for one of primary valvular disease.

Prognosis.—It is difficult to furnish satisfactory prognostic statements in many cases, for it is remarkable that some persons with well-marked sclerotic arteries live to an advanced age and suffer none of the serious or even annoying consequences usually accompanying this condition. On the other hand, the subjects of a slight degree of arterial degeneration, presenting almost no clinical evidence of the existence of the same, may, owing to cerebral hæmorrhage or other causes, progress rapidly to a fatal issue. The prognostic data in any given case are obtainable only after a careful examination of the entire patient.

Treatment.—The treatment of arterio-sclerosis must be largely of a preventive character, and based on general considerations. When a person manifests the slightest evidence of developing this condition, his entire mode of life must be inspected, and as near an approach as possible to physiological living adopted. The food must be nutritious, simple, and free from stimulating articles of all sorts, and especially from alcoholics. Very active exercise must be avoided, plenty of sleep taken at night, and if possible, the patient should take a regular hour at mid-day for recumbency and sleep. Constipation must be avoided; the skin should be made active by frequent bathing, and the patient most carefully prescribed for. *Chloride of gold* in the second decimal trituration, three times daily, given for a long period, has proven to be the most serviceable

remedy. If a gouty or syphilitic history exists, the diet, etc., must be carefully regulated for the former and antisyphilitic treatment adopted for the latter. *Iodide of potassium* in crude doses is the principal remedy in the syphilitic cases, although even here the *chloride of gold* will be found applicable. *Cuprum sulph.* 2x, given night and morning, has also been of some service in syphilitic cases. *Iodide of lead* 3x may be given in the same manner if there are constipation, colicky pains and interstitial nephritis. *Nitro-glycerin* in doses of one drop of the first centesimal solution is most relied on by old school authorities. By lessening intravascular pressure, it accomplishes much in the way of giving temporary relief. The patient soon becomes accustomed to the drug, so that its effects are not permanent. It is better to reserve its use for times when the intravascular tension is so great as to produce discomfort and threaten serious consequences. Bleeding in all stages, as advocated by Huchard, is certainly of questionable value. When cyanosis is present and there is great distention of the right ventricle, it is possible that life may be prolonged for a short time by this measure. Huchard is an earnest advocate of iodide of potassium in non-syphilitic cases, claiming that the drug exerts a beneficial influence on the nutrition of the blood-vessels. Of late the *iodide of strontium*, in doses of from five to ten grains three times daily, has come into use and seems to have a most beneficial effect. The provings of strontium would indicate that this drug should have a beneficial influence on sclerotic conditions generally. Jousset speaks very highly of both of these medicines. In cases in which gangrene has become a complicating factor, *arsenicum*, *secale* and *lachesis* are the most suitable remedies.

ANEURISM.

The general and extended consideration of the subject of aneurism is usually relegated to works on surgery. Inasmuch, however, as aneurism involving certain vessels, notably the thoracic aorta, is of special interest to physicians, the subject demands attention in the present volume.

Definition.—We understand by the term "aneurism" a circumscribed dilatation of an artery, which may or may not be attended by rupture of one or more of its coats. The walls of the aneurism may be composed entirely of the vascular coats, or in part by the surrounding tissues. Aneurismal tumors have been divided into two varieties, the true and the false. A true aneurism is one, the sac of which is composed only of arterial tissue, while the walls of false aneurisms are constituted in whole or in part of neighboring structures. Some authors apply the term "true" to cases in which the artery is dilated, but all of its coats intact. As this variety represents but a comparatively small number of the cases, the wisdom of such a limitation in nomenclature is open to criticism.

According to their shape, aneurisms have been further divided into fusiform, dissecting, sacculated, cirsoid, and arterio-venous aneurisms. The fusiform variety consists of a more or less uniform enlargement in the entire circumference of the vessel. A sacculated aneurism appears as a globular mass or sac protruding from one side of the artery. Communication between the tumor and the artery may be either by a large opening or by means of a constricted portion or neck. In the latter case the opening into the aneurism sometimes consists of but a small aperture. A dissecting aneurism is one in which the blood current has perforated part of the vascular walls, and separated or dissected the intima and the media from the outer coat. The truant blood current after coursing for a distance within the arterial walls may again enter the vessel. Dissecting aneurisms are especially apt to involve the aorta. A rare form of aneurism is the arterio-venous, which is the result of a communication established between an artery and a vein. A sac may intervene between the two vessels, in which case the condition is spoken of as a varicose aneurism. Rupture of an aneurism with infiltration of the surrounding tissues and the development of an inflammatory wall of limitation is called a diffused aneurism. A cirsoid aneurism is one involving a main trunk and branches given off from the same.

Etiology and Pathology.—The causes of aneurism may be summed up as including all those agencies which lessen the resisting power of the vascular walls and increase the intra-arterial pressure. Of the influences weakening the arterial walls, arterio-sclerosis occupies first place, although the truth of this statement has been doubted by reason of the fact that the majority of cases of aneurism appear at or about the fortieth year, while arterio-sclerosis is most pronounced in advanced life. Still this apparent discrepancy can be reconciled. The vascular degeneration becomes etiologically active only in the presence of increased blood pressure. Inordinate muscular exertion is an important cause of the latter condition. Arterial degeneration not infrequently begins at about the age of forty years, and at that time of life, moreover, patients are still physically active and exposed to the accidents of undue muscular effort. The two causes thus meet and give rise to aneurism.

All of the causes of arterio-sclerosis, syphilis, alcoholism, gout, rheumatism, Bright's disease, muscular strain, etc., have been arraigned as influencing the production of aneurism. Clinical studies serve to show that in the majority of cases, two or even more of these causes are found to be operative. Heredity undoubtedly exerts a very important influence in the production of diseases of the vascular system, much more important than has thus far been granted. Lancisi reports a remarkable case in point, in which aneurisms occurred in three succeeding generations.

Age has an important influence, the majority of cases developing in middle life, *i. e.*, between the ages of thirty-five and fifty-five years. The

earlier appearing cases are apt to be the result of a combination of causes, viz., syphilis, alcoholism, and laborious occupations, an etiological trio frequently observed. Aneurism is rare in children. Men are far more frequently attacked than are women.

The onset of the disease is often traced to some undue exertion or strain leading to sudden increase in the arterial tension, and consequently to rupture of one of the arterial coats. It is not an uncommon thing for the patient to say that he felt something give way while he was making some unusual effort. When prolonged arterial tension already exists, the degree of suddenly developed strain required to rupture one of the arterial coats is often surprisingly small. Thus aneurism has been caused by lifting moderately, straining at stool, coughing, running, etc. Traumatisms, especially injuries to the chest, have been the cause of some aneurisms. The immediate effect in some instances is rupture of an arterial coat; in others, there follows a low inflammation of the arterial walls, leading to their weakening and subsequent dilatation. Wilkes and Moxon have found aneurism to result also from a low inflammation originating in rheumatism, or from proximity of the artery to the walls of an abscess.

Aneurism in the smaller arteries may follow closely upon embolism, the plugging of the artery resulting in increased pressure behind the obstruction and localized inflammation. If the emboli are septic, the aneurisms are apt to be multiple.

Some persons seem to have a remarkable tendency to aneurism, cases having been reported in which these tumors existed in several portions of the body; and also instances in which after recovery from one aneurism, others developed in different places after a term of years.

The walls of the aneurism usually consist of thickened intima and adventitia. The tunica media is usually the first to undergo degeneration, Köster contending that a chronic inflammatory process is developed in this structure. Fibrous bands are thus formed, and these destroy the muscular tissue. The walls of the aneurism finally begin to thin as the tumor increases in size, until finally the aneurism ruptures. The doctrine of the development of aneurism owing to vaso-motor disturbances and independently of structural changes in the muscular coat has been advocated by some (Eichhorst), but seems to have little to commend it to serious consideration.

The aneurismal tumor usually contains blood clots, which are often arranged in lamellæ and are partially organized. Cures may take place by reason of these coagula. They ofttimes present a source of danger, as portions of the coagulated blood mass may become separated, and cause embolism of a distant vessel. The older thrombi in contact with the vessel walls are yellowish, and often contain lime salts. Coagulation changes and their results are most marked in the sacculated variety of aneurism, because

in them the communication between the artery and the sac is a small one, and the contents of the latter are not disturbed by an active blood current. Degenerative changes sometimes take place in the coagulum, as liquefaction or calcification. Arteries springing from the main trunk at the seat of the aneurism sometimes become occluded.

The influence of aneurismal tumors upon surrounding structures is best considered in connection with the several varieties of the same to be described very shortly. The bad consequences of aneurism grow out of the tendency of these tumors to continuous enlargement with the resulting pressure upon surrounding organs and their subsequent rupture. The parts to suffer most frequently from compression are the lungs, the bronchi, the œsophagus, the trachea, the large vessels at the base of the heart, the vagus, the recurrent laryngeal nerve, and the bones of the chest. Rupture may take place externally through the integuments, or internally into the pericardial or pleural cavities, into the lungs, or into the large bloodvessels or cavities of the heart.

Aortic aneurism soon exerts an important influence upon the heart structure, producing hypertrophy, dilatation, or atrophic and fatty changes.

Clinically, aneurisms present themselves as pulsatile tumors in the course of a bloodvessel. The pulsation is expansile in character, and ceases as soon as pressure is made upon the artery above the tumor. Auscultation discovers the presence of a bruit. Pressure on the vessel above the tumor sometimes leads to its collapse, the degree to which this takes place being in a measure a pretty reliable guide as to the fluidity of the contents of the sac.

ANEURISM OF THE THORACIC AORTA.

The aorta, and especially its thoracic portion, is the vessel most frequently affected by aneurism. The relative frequency of the involvement of the thoracic and abdominal portions of this great bloodvessel is as three to one. Of aneurisms of the thoracic aorta, the ascending portion of the arch is affected in about one-half of the cases; the remaining half is nearly evenly divided between the transverse portion of the arch and the descending thoracic aorta, with a probability that the former is of greater frequency than the latter. Rare instances in which the aneurism develops within the pericardial sac have been reported. Sometimes the tumor starts in the sinuses of Valsalva, and may there attain quite a large growth. Intra-pericardial aneurisms are usually of small size and are liable to very early rupture. The anterior or convex surfaces of the aorta are usually attacked, the exceptions being those cases in which the descending portion of the arch is involved, in which case the tumor more frequently projects posteriorly. The direction of bulging, however, is governed largely by the situation of the points of strongest impingement of the blood current.

The size of thoracic aneurism varies from a slight dilatation hardly sufficient to produce any disturbance in health, to a tumor as large as the capacity of the chest and its contained organs will permit. An aneurismal sac may contain secondary pouches or diverticula, or there may be multiple tumors, these also varying greatly in size. When involving the ascending aorta, the tumor tends to develop in a forward direction, resulting in erosion of the upper portion of the sternum, the right upper ribs, and the costal cartilages. If the transverse aorta is involved, the growth is upward and forward, and sometimes to the right. In some of these cases the orifices of the innominate, right subclavian and right common carotid are involved in the aneurism. If the aneurism is of the descending aorta, the trachea or the bronchi are usually compressed, and the development of the tumor backward may result in erosion of the vertebræ. Aneurisms in this location usually make their presence manifested to the left of the spine, *i. e.*, between the spinous processes and the inner border of the left scapula. Aneurismal protrusions from the concave surface of the aorta are not common. Pressure in such cases is exerted mainly upon the pulmonary artery and the right ventricle if the ascending portion of the arch is involved, and upon the œsophagus and trachea when the transverse portion is the seat of the aneurism.

Symptomatology.—If, as stated, the most important symptoms of aneurism are the result of compression of neighboring organs by the tumor, the clinical picture must vary considerably with the location and proportions of the growth. In certain situations, aneurisms of considerable size may fail to develop evidence of their presence, and so make their existence first known only when they rupture, or at the autopsy. From this it necessarily follows that an aneurism of considerable size is not incompatible with apparent good health. Owing to the more limited space for expansion—the antero-posterior diameter of the chest at this point is less than elsewhere—aneurism of the transverse portion of the arch is attended by an earlier development and a higher grade of symptoms than are aneurisms of the ascending or descending aorta. The most important symptom is the appearance of a pulsatile tumor. Such a growth may attain a large size. Bamberger, for example, reports an instance in which the chin rested upon an aneurismal tumor of the arch of the aorta. The progress of the growth may be exceedingly rapid, daily changes being visible in extreme instances. Oblique illumination of the chest assists greatly in the examinations during the early stages of the trouble. The skin over the tumor is smooth and shiny, and later may present an inflammatory or a gangrenous appearance.

In the very large group of cases in which a tumor is not present at he time the patient is first seen, or in which an appreciable tumor does

not develop until late, attention must be given to the symptoms and physical signs. Of the former, pain is one of the most important. When the aneurism has been caused by traumatism or a sudden strain, the rupture of the arterial wall and the subsequent tension upon nerve filaments may give rise to a dull localized pain in the region of the injury. Very often, however, such early pain is absent. The pain attendant upon the developed aneurism and the one exciting the most distress is of a boring, gnawing, burning character, and arises from severe pressure upon surrounding tissues. Presumably most important in its production is pressure upon the bones, especially upon the bodies of the vertebræ as in the case of aneurism of the descending portion of the arch. Sometimes the pain is so torturing in character as to culminate in maniacal symptoms. It occasions even greater suffering than does the more or less paroxysmal neuralgias resulting from pressure of the tumor upon the intercostal and other nerves. Exceptionally, cases are observed in which the bones are extensively eroded and no pain has been produced. Anginal attacks are sometimes present; they are especially apt to constitute a prominent feature of cases in which the aneurism is situated near the heart. A study of the character and location of the pain is of much value in diagnosis, affording assistance in the localization of the tumor. Aneurism of the transverse portion of the arch is accompanied by pain along the left arm, and extending to the neck and occiput. Aneurism of the descending aorta is apt to produce neuralgia of the intercostal nerves; when the tumor is situated just above the diaphragm the pain is such as to closely simulate that of lumbago.

Dyspnœa is another important symptom; it is always present in connection with large tumors; often with small ones if unfavorably located. It may be due to pressure upon the lungs, trachea, bronchi, pulmonary vessels, or upon important nerves, as the pneumogastric and recurrent laryngeal. When the pressure is upon either of the nerve trunks enumerated, the dyspnœa may be paroxysmal and severe. The physical signs of diminished expansion of the chest on one side and bronchial catarrh, weak or absent tactile fremitus and sibilant or sonorous râles, will be present. Secondary lung changes, bronchiectasis and pulmonary consolidation may attend. The retention of bronchial secretions leads to fever. Pressure upon the mucous membrane of the bronchial tubes often causes slight bleeding and hæmoptysis. Sometimes the aneurism ruptures into a bronchial tube, in which case the hæmorrhage is profuse and often rapidly fatal. In some cases the hæmoptysis seems to be beneficial rather than otherwise.

Pressure upon the pneumogastric nerve often results in a widespread diffusion of symptoms; *i. e.*, in vomiting and various symptoms referred to the abdominal organs, asthmatic seizures, and angina pectoris. From

pressure upon the recurrent laryngeal nerve certain laryngeal symptoms arise; *e. g.*, hoarseness, or if this has not yet developed, the voice is weak and husky and deficient in timbre. Examination with the laryngoscope shows these symptoms to be due to paresis or paralysis of one or both vocal cords. In the early stage spasms of the laryngeal muscles may cause stridulous breathing. The abductors are first affected. It must be remembered, however, that often when but one vocal cord is paralyzed, there may be no apparent alterations in the voice.

Pressure upon the veins within the thorax, especially upon the superior innominate vein, the superior vena cava or the right auricle, results in venous engorgement, and later in œdema of the head, neck, upper extremities and chest. These parts may even become cyanotic. Headache and various symptoms of interference with the circulation within the head may be present. The distribution of these symptoms will depend upon the vessels obstructed. With failing heart, they are still further increased. Less frequently the lower portion of the body and the lower extremities become œdematous from pressure upon the inferior vena cava. Pressure upon the azygos veins causes cyanosis of the lower portion of the chest. Pressure upon the sympathetic develops in some instances vaso-motor phenomena in the head and neck. At first, when the sympathetic nerve is suffering irritation, the pupil of that side is dilated, and the skin shows pallor; but with its paralysis, there are flushings and sweating in the involved area and contraction of the pupil. A prominent symptom group may result from pressure upon the branches of the brachial plexus and the intercostal nerves. Exceedingly severe neuralgia and motor pareses arise within the nerve districts involved.

Deglutition may be affected by pressure of an aneurism of the descending aorta upon the œsophagus. Less frequently pressure of the enlarged transverse portion of the arch may cause reflex contraction from disturbance of the nerve supply; this will be indicated by paroxysmal dysphagia. In either case nutrition is impaired and emaciation results. The pulses, as observed in the radials, are often unequal, and not synchronous. They may also differ in volume. The latter peculiarity is more apt to be present when the aneurism involves the large arteries given off by the arch. Osler calls attention to "obliteration of the pulse in the abdominal aorta and its branches," the aneurismal sac constituting a reservoir which, on the principle of the modern syringe, changes an intermittent into a continuous stream.

Physical Signs.—Only after an aneurism has attained sufficient size to approach the chest wall do physical signs enable us to make a diagnosis. Prior to this time, pressure symptoms, especially those resulting from the mechanical action of the tumor on the lungs and bronchial tubes, are often present. The great variations in the intensity of the

pressure symptoms and the physical signs are dependent in very great measure upon the location of the aneurism. Thus aneurism involving the ascending aorta and first portion of the arch has been spoken of as the aneurism of physical signs; of the last portion of the arch and the descending aorta, the aneurism of pressure symptoms.

Inspection and Palpation. Distention of the intercostal spaces, associated later with erosion of the bones and the appearance of a pulsating tumor, is the most important and conclusive evidence of aneurism. The swelling usually appears to the right of the sternum and above the fourth rib, when the aneurism is of the ascending aorta; more or less of the upper sternal area may be involved. Pulsation is usually first felt in the second and third interspaces. If these signs are to the left of the sternum, they suggest aneurism of the transverse portion of the arch. Less frequently the tumor appears posteriorly as low as the third dorsal vertebra, in which case involvement of the descending aorta is indicated. The overlying integuments sometimes present changes, even to gangrene. The lowering and extension of the apex beat to the left results from displacement of the heart or coexisting valvular disease and hypertrophy. If the aneurismal sac does not contain too many clots, an expansile pulsation may be detected. In cases in which this phenomenon is but slight, a neat expedient for its detection is found in the pasting of small pieces of paper edge to edge over the suspected spot. If the pulsation is expansile the edges will be seen to separate with each distention. The pulsation is generally systolic in time, and may be attended by a thrill, especially in non-saccular aneurisms. Pulsation in the suprasternal region may sometimes be felt in aneurism of the tranverse section of the aorta. When the innominate artery is involved, the pulsation is observed high above the second rib, and extends to the neck on the right side.

Percussion. Areas of dulness to the right or left of the sternum and involving the upper sternal region, often merging with the cardiac dulness, are very significant. A dull area may be observed posteriorly between the scapula and the spine upon the left, and about the level of the third dorsal vertebra.

Auscultation. Murmurs may or may not be heard over the aneurism. They are usually absent if blood-clots fill much of the sac. They are generally systolic although a diastolic murmur may be superadded from disease or overdistention of the aortic region. The heart sounds may be heard over the tumor. The second sound especially may be sharply accentuated, constituting an important sign when heard over an area of suspicious dulness. The diastolic murmur may also be heard when the aneurism is situated near the aortic valves, which are thus rendered incompetent from overstretching of the aortic orifice or from secondary disease of the valvular segments. Sometimes aneurismal murmurs are very loud. Pepper reports one case in which it was heard at a

distance of six feet from the patient. A systolic murmur is sometimes heard over the trachea, and has been attributed to the sudden expulsion of air from this tube with each distention of the tumor.

The Pulse. When the aneurism involves the ascending aorta the pulsations in all the arteries are found to take place much later than the heart-beats. The strength of the pulsations is also weaker than normal. When the transverse portion of the aorta but not the innominate artery is involved, the pulsations in the right arm and right side of the neck are normal; those of the left side are weak and retarded. It is important in all cases to compare the accessible vessels on both sides. The sphygmographic evidences of aneurism are important. The upstroke is slanting, the summit broad and the various waves of the downstroke obliterated.

Tracheal Tugging. This phenomenon as evidence of aneurism was first described by Oliver, and its value in practice confirmed by Macdonnell, Osler, and others. The process of investigation is described by Oliver as follows: "Place the patient in the erect position and direct him to close his mouth and elevate his chin to the fullest extent, then grasp the cricoid cartilage between the finger and the thumb and use gentle upward pressure on it, when, if dilatation or aneurism be present, the pulsation of the aorta will be distinctly transmitted through the trachea to the hand. The act of examination will increase laryngeal distress should this accompany the disease." This symptom is all the more valuable because it appears very early in the course of the disease.

Diagnosis.—The diagnosis of aneurism of the aorta is attended with great difficulty, indeed is sometimes impossible until a pulsating tumor appears externally. The deep situation of the tumor is sufficient reason for the obscurity which surrounds its recognition in its early stages. At this period of its course reliance must be placed upon symptoms of pressure, such as obstinate and increasing neuralgia, obscure chest pains, paresis of the vocal cords, impairment of pulsation in the abdominal aorta and its branches, etc. When a tumor can be recognized, differentiation between a possible aneurism and a solid growth is indicated. Suggestive of a solid growth is dulness, which is not so clearly confined to the region of the aorta as in the case of aneurism; a systolic murmur may be present, but is not likely to be succeeded by an accentuated second sound. If pulsation is felt it is not as forcible as in aneurism and does not possess the expansile character of the latter. If the respiratory sounds are altered, they are bronchial in character over a solid growth, while they become feeble or suppressed in aneurism. The fact that most aneurisms occur in men, and that there is usually an absence of the cachectic appearance so commonly associated with solid growths in the chest, will afford much assistance.

Glasgow has made recent claims for a symptom which he regards as

strongly significant of the presence of aortic aneurism. It consists of the presence of a systolic sound or thud synchronous with the systole of the heart, sometimes accompanied by arterial murmur, and heard with the stethoscope placed over the brachial artery. This same sign was formerly described by Skoda as occurring in aortic regurgitation, which lesion must, of course, be excluded.

Aneurism of the innominate artery can seldom be distinguished from aneurism of the aorta. But if the physical signs indicate a growth toward the right sterno-clavicular junction, if the pulse in the right radial artery is retarded, and feeble or extinct, if evidences of pressure upon the right bronchus, superior vena cava, or right brachial plexus exist, it may be suspected.

In pulsating empyema there is an absence of pressure symptoms and the dull area is not limited to the aortic region. The auscultatory phenomena of aneurism are absent, as is also the expansile pulsation. Neurotic pulsation of the aorta simulating aneurism has been described by Bramwell.

Prognosis.—Sudden death after a long period of latency of symptoms is not an unusual termination of aortic aneurism. The rapidity of the fatal issue when brought about by rupture will depend upon a variety of circumstances. If the hæmorrhage takes place into the pericardial sac death occurs at once from compression of the heart. If into the heart, lungs or bronchial tubes, there is the element of obstruction of respiration added to the loss of blood. The fatal hæmorrhage may occur with great rapidity, or there may be repeated smaller losses of blood with anæmia as a consequence. This is especially apt to be the case when the rupture is through the wall of the chest. A curious group of symptoms follows upon the rare rupture into the pulmonary artery, vena cava, or venous heart, the most important being venous pulse, a murmur over the point of perforation, systolic in time, and serious circulatory disturbances with dropsy.

Should death from rupture not occur, the case pursues a more or less chronic course, with a prominence of pressure symptoms, the nature of which depends upon the location and size of the aneurism.

Pericarditis, bronchitis, pneumonia, destructive lung lesions, pleurisy, aortic disease, obstruction of the œsophagus, thoracic duct, bronchial tubes or pulmonary artery, and pressure upon the nerve trunks, are some of the sequential conditions which give rise to prominent symptoms. Before a fatal result has been reached in consequence of asthenia or some of these complicating conditions, the patient may die of failing heart. Recovery from aneurism is rare. The prognosis is therefore unfavorable, although the possessor of the disease sometimes lives on for years in comparative comfort. Spontaneous recovery sometimes takes place.

Treatment.—The treatment of aneurism is generally unsatisfactory.

Nevertheless many spontaneous recoveries have taken place, as obliterated aneurismal sacs have been found post mortem in persons in whom their existence had not even been suspected during life. Drugs and general measures are in most repute by way of treatment. The methods in vogue in aneurism of superficial vessels, viz., compression and distal and proximal ligation, are, of course, inapplicable to the aorta. The treatment which finds most favor is, first and simplest, the method by diet and rest, known as Tufnel's treatment, because advocated by Tufnel, of Dublin. The essential features of this plan are rest, if possible in bed, and the reduction of the food allowance, especially its liquid portion, to a minimum. The result of this plan is lessening of blood pressure and quieting of the circulation, both of which favor coagulation of the blood within the dilated vessel. It is suggested that about ten ounces of solid food and eight ounces of liquid be divided into three meals, to be taken during the twenty-four hours. Many cases of successful application of this plan have been reported.

Venesection has its advocates and is suggested in the early stages. Quantities of five to ten ounces of blood are abstracted every one to two weeks. This may be done in persons who are not anæmic, but the production of a marked degree of anæmia by this method is to be condemned.

Certain drugs, especially iodide of potassium and ergot, are believed to possess an influence upon the sac and its contents. Iodide of potassium, in doses of from five to thirty grains three times daily, is recommended by many observers. Some consider the smaller doses sufficient to accomplish all the drug is capable of. Balfour strongly recommends the larger amount. Its favorable action seems to be due to a lowering of the blood pressure, as well as to a specific action upon the diseased vessel. As most patients with aneurism are claimed to be syphilitic, the beneficial result may be due in some degree to a control of this factor. It is generally agreed that iodide of potassium possesses great influence over the course of aneurism.

Ergotine was first employed by Langenbeck, who made injections of the aqueous extract of ergot into the region of the sac. Contraction of the muscular fibres in the wall of the sac is then the rationale of its action. General experience does not appear to support this method. Astringents, such as tannic acid and acetate of lead, are recommended, but there is little evidence of their value.

Galvano-puncture has been successfully performed in a few instances. Ciniselli reported twenty-three cases with five cures, a most favorable showing. In aneurisms of the sacculated variety, of small size, it may be employed with some hope of success. The steps consist of introducing into the sac a needle insulated except at its point, to which the positive pole is attached. The negative electrode, which must be large, should be applied over the abdomen. The current should pass for from

one to three or four hours. Prior to operating, the apparatus should be tested in fresh blood or egg albumin, that successful action may be demonstrated. The importance of introducing the anode or positive pole will be appreciated from the firmness of the coagulum which forms about that needle, as compared with the soft mass filled with bubbles of hydrogen gas which appears at the cathode or negative pole. The danger of embolism appears to be but small if the operation is performed in the above manner.

Introduction of foreign substances, such as fine silver wire, catgut and horse hair, have been recommended, and many cases so treated. This plan may be combined with electrolysis. The wire, kept tightly wound about a spool, is passed through a perforated needle into the sac, when it curls again. To this wire the positive pole is attached and the treatment carried out as in galvano-puncture. The various methods which aim at the formation of a coagulum within the sac seem faulty in principle, and results are not encouraging. The resulting coagulum does not form in lamellæ upon the dilated walls of the artery, as when produced by nature, and may constitute a soft embolus lying free in the aneurismal cavity.

Ligation of the carotid and subclavian arteries has been practised in some cases with but little result, however.

Medicines must be prescribed upon general principles, and may afford some relief. Careful selection will lessen the necessity for morphia, which may sometimes be necessary to control the intolerable and unconquerable pains.

ANEURISM OF THE ABDOMINAL AORTA.

Aneurism of the abdominal aorta is of far less frequent occurrence than is the same lesion involving the thoracic portion of this great artery. The sac is especially liable to form about the region of the cœliac axis; in a very small proportion of cases the dilatation occurs at the bifurcation of the aorta. The aneurism may assume the fusiform, sacculated or any of the other usual varieties; it may also be multiple. Men in middle life represent the great majority of subjects, and the etiological factors at work are generally the same as those already presented for thoracic aneurism.

Pain is the earliest and most pronounced of the symptoms, and is due especially to pressure exerted by the tumor upon the nerve trunks and the vertebræ. Its character varies in different cases and in different stages of the same case. Several varieties of pain may be distinguished: First, acute lancinating pains, felt anteriorly even as far as the umbilicus, or extending downward even into the lower extremities; secondly, dull boring pains resulting from pressure and erosion of the vertebræ; thirdly, paroxysms of pain mostly of a gastralgic character;

fourthly, colicky pains in the abdomen due to embolism of the mesenteric artery.

Hyperæmia of the various abdominal organs, especially of the liver and spleen, is common, owing to the pressure exerted by the aneurism upon the venous trunks. Jaundice may be present. Gastric disorder is common; vomiting is not unusual. The pressure upon the vertebræ may result in extensive erosion of their bodies, destructive changes in the cord and paraplegia. Usually the aneurism projects forward and is detected centrally or to one side of the median line, usually the left. If situated high up, it is well covered by the diaphragm, and is not liable to be discovered until it has attained a large size. Usually, however, the yielding nature of the abdominal walls makes the discovery of an aneurism of the abdominal aorta possible before it has reached the size necessary in cases of the thoracic disorder.

Physical Signs.—Inspection and Palpation. A pulsating tumor may be visible, or it may be appreciable to palpation. Its most frequent position is just above the umbilicus and to the left of the median line. The essential feature of this tumor is an expansile pulsation. This must be remembered, for it is in this region that pulsating aorta of neurotic origin is most often observed. Such neurotic pulsation may at times be astonishingly forcible and deceive the careless observer. There may be a systolic thrill, and if the tumor is in contact with the diaphragm, a diastolic impulse may be transmitted from the heart. Systolic sounds are more often heard over the tumor than are diastolic. Frank has proposed a test for the presence of aneurism, which is as follows: Pressure upon the sac will result in increase of tension in the vessels below, which is most easily determined in the femoral arteries. The removal of pressure is followed immediately by great feebleness or loss of one or more beats. The risks of rupture of the sac in practising this test are such as to make it inadvisable for ordinary clinical work.

Prognosis.—Recovery from abdominal aneurism is rare. Spontaneous recovery may, however, occur as in the case of thoracic aneurisms. The fatal issue is usually due to rupture internally. This may take place into the peritoneal sac or retroperitoneal space, or into the neighboring hollow organs, as the stomach, duodenum, bladder, or the pleura. Rupture into the vena cava with consequent circulatory disturbances has been observed. Perforation of the abdominal walls is rare.

Treatment.—The general treatment of abdominal aneurism is the same as that recommended for other aneurisms of the aorta. A special, though withal a dangerous method of treatment has been recommended, consisting of pressure upon the proximal side of the tumor while keeping the patient under an anæsthetic. Such pressure has been continued for over fifty consecutive hours. The risks incurred are mechanical injury to surrounding tissues and rupture of the sac.

ANEURISM OF THE BRANCHES OF THE ABDOMINAL AORTA.

The various branches of the abdominal aorta, notably the cœliac axis, the mesenteric, splenic, hepatic, and renal arteries, may be the seat of aneurism.

The *cœliac axis* is quite frequently involved in aneurism of the upper section of the abdominal aorta. The *splenic artery* is next in frequency the seat of this lesion.

The *hepatic artery* is but rarely affected by aneurism. But a few cases have been reported. The symptoms are not at all characteristic. Especially apt to appear, are pain in the right hypochondrium, and icterus from compression of the gall duct. Hæmorrhage into the gall duct has taken place and gives rise to symptoms simulating those of hepatic colic.

The aneurisms arising from the aortic branches are rarely of large size, generally not reaching that of a hen's egg. They thus give rise to few or no symptoms in many instances. They may rupture; but owing to the small size of the vessels, such an accident is not necessarily fatal.

Aneurism of the *mesenteric arteries* is very rare. The superior mesenteric artery is the one most frequently attacked. A tumor with a systolic murmur may be found in the median line. Pain in the tumor or posteriorly in the lumbar region, gastric irritation, and symptoms of intestinal infarction are the most suggestive indications.

Aneurisms of the *renal arteries* are not rare. They are usually small. Rupture takes place most frequently into the retro-peritoneal space.

Multiple aneurisms are usually of small size, thus making cases of this character decidedly obscure. The symptoms are mainly pain and gastric disturbance. The pain may be referred to the back. Hæmatemesis and fatal hæmorrhage from the bowels have been reported. Rupture may occur into the stomach, bowels or peritoneal cavity.

CONGENITAL SMALLNESS OF THE AORTA.

Congenital smallness of the aorta has been frequently observed, especially in women the subjects of chlorosis. In general it has attended slow growth and delayed physical development, especially of the general vascular system and genital organs. Virchow observed it in the subjects of hæmophilia. Weakness, paleness, and anæmia, are usually present. The aorta is small, often no larger than one of the larger arteries of the body. The media and intima are thin and may be fatty. Endarteritis may cause the intima to pucker or lie in folds. The intercostal arteries are often given off irregularly. The heart may be small, hypertrophied or dilated. Aside from anæmia, there may be palpitation, a syncopal tendency, and the general symptoms of insufficient blood or faulty circu-

lation. It seems a favorable condition for the formation of gastric ulcer, endocarditis, hæmophilia, etc. Menstruation may be delayed, absent or excessive.

A systolic murmur due to irregular vibrations of the aortic walls may be heard over the præcordia.

DILATATION OF THE AORTA.

Some authorities recognize a uniform dilatation of the aorta, especially of its arch. A clinical separation of this from aneurism does not seem possible. Neither is it with certainty recognized anatomically at the autopsy.

CONSTRICTION OF THE AORTA.

Constriction of the aorta, of congenital origin, has been observed. The lesion is usually found external to the left subclavian artery; *i. e.*, at the isthmus of the aorta, this portion of the vessel retaining its fœtal size. The vessel exhibits upon its inner surface at the point of constriction a puckered and furrowed appearance, to which thrombi may be attached. Behind the constriction the aorta is dilated. The left ventricle is often hypertrophied and dilated, and the aortic and mitral valves diseased. The mechanical obstruction to the blood current tends to the formation of atheroma and aneurism. Sometimes the aorta tapers down to the point of obstruction, resuming its natural size below. The establishment of a collateral circulation through branches of the subclavian arteries, which enlarge and communicate with arteries given off from the aorta below the obstruction, prevents rapidly serious results; indeed, remarkable instances in which this lesion has produced little or no inconvenience have been recorded. The symptoms noted in these cases have been severe headache, dyspnœa, cough, hæmoptysis and vertigo. The condition can only be recognized during life by the marked throbbing of dilated arteries around the shoulders and ribs, and by the differences in the strength of the pulsations in the arteries of the upper and lower limbs.

New growths and syphilitic lesions sometimes result in acquired constriction of the aorta.

RUPTURE OF THE AORTA.

This is a very rare accident, occurring very seldom even in cases in which the aorta is diseased. It has followed upon blows, falls, wounds of the chest, etc. In some cases the rupture has extended through only one of the coats of the vessel, resulting in a dissecting aneurism. For the most part rupture of the aorta is the result of various degenerative processes conjoined with undue physical or mental strain as an exciting cause. Rupture occurs most frequently near the heart with a resulting

hæmopericardium. It may take place, however, into the posterior or anterior mediastinum, and but rarely into other vessels or into the heart itself. The solution of continuity is usually transverse, and may involve one-half or more of the circumference of the vessel. The symptoms are those of internal hæmorrhage, agony, shock, pain and collapse. Death usually takes place rapidly. If life is prolonged the physical evidences of a collection of blood in the pleural or pericardial sac or mediastinum may be elicited.

ANEURISM OF THE PULMONARY ARTERIES.

The lesions productive of aneurism are not common in the pulmonary artery, hence aneurism of that vessel is a rare affection. Of 915 cases of aneurism collected by Crisp, but four involved the pulmonary artery. A more or less general dilatation of the vessel and its branches occurs as a result of mitral obstruction or chronic pulmonary lesions, and must not be confounded with aneurism. Death may occur from rupture of the sac, especially from rupture into the pericardium. The tumors are seldom of large size. Occasionally aneurisms are formed in phthisical cavities by reason of the loss of support to the vessels afforded by the normal lung tissues. The general dilatation of the pulmonary artery above referred to sometimes paves the way for an arterio-sclerosis.

Symptomatology and Physical Signs.—The symptoms of aneurism of the pulmonary artery are uncertain and by no means diagnostic, hence the condition is rarely recognized during life. The most characteristic symptoms are those indicative of a weak right heart and disturbance of the pulmonary circulation. There is generally complaint of cough and expectoration, dyspnœa and cyanosis. The symptoms may present a strong similarity to those of aortic aneurism, if the tumor is large enough to exert much pressure. To the left of the sternum in the third interspace, pulsation and prominence may be detected. A thrill may attend the systolic pulsation, and the closure of the pulmonary valves may communicate a diastolic vibration. The value of percussion in diagnosis is much diminished by reason of the fact that this region is often dull, as the result of retraction of the lung. Emphysema may also mask an aneurism in this location. Dulness is usually present, however, over the area of pulsation and perhaps higher. Auscultation reveals a rough systolic murmur propagated upward and to the left. A good point for differentiation from aortic aneurism is that in the latter hypertrophy involves the left ventricle; in aneurism of the pulmonary artery it is the right ventricle that is enlarged.

The Prognosis is no better than in the case of other internal aneurisms.

ANEURISM OF THE CORONARY ARTERIES.

The coronary arteries may be the seat of aneurisms. Either vessel, in any portion of its course, may be involved. The tumor may be sacculated or fusiform, or the affected artery may be dilated throughout its course. As a rule, the aneurisms are few in number, rarely being more than three. They are generally the result of arterio-sclerosis or embolism. Rupture may take place into the pericardium, or, as I observed in one case, into the heart substance itself, leading to anginal attacks, vomiting and finally hæmorrhage into the pericardium. Usually aneurism of the coronary arteries produces no symptoms until rupture takes place. The size of the aneurism ranges from a slight dilatation to a tumor as large as the walls of the heart will permit.

ARTERIO-VENOUS ANEURISM.

A communication between an artery and a vein usually results from a wound, as in venesection. Should the vessels become adherent, and the arterial blood pass directly into the vein, the latter, with all its branches, becomes dilated. To this condition the term aneurismal varix has been applied. But when an intermediate sac is formed, or an aneurism bursts into a vein, the condition is designated varicose aneurism. The forms of this lesion most important to the physician occur within the chest. Such a communication has been shown to take place between the aorta and the pulmonary artery, and between the aorta and the vena cava. In the case of the latter the result is excessive dilatation of the veins of the head and upper portion of the body, combined with blueness of the surface and œdema. The development of the symptoms may be sudden. The most important physical sign is a continuous murmur intensified with each systole.

Diseases of the Veins.

The diseases of the veins which will be considered are acute and chronic phlebitis, and dilatation of the veins.

ACUTE PHLEBITIS.

Definition.—Inflammation of the veins.

Etiology and Pathology.—For a correct appreciation of the etiology of acute phlebitis, a knowledge as to the manner in which the inflammatory process begins is a prerequisite. A study of the subject shows that the inflammation may begin in the walls of the veins themselves, or these vessels may become involved by contiguity with other inflamed structures. In the former case the phlebitis not infrequently arises from the direct action of toxic substances circulating in the blood on the venous walls; or, as a result of blood changes, a thrombus forms and phlebitis sets in. The latter we speak of as a thrombo-phlebitis; the former, in which the surrounding tissues are also invaded, as periphlebitis.

The constitutional causes of phlebitis are the first to demand attention. They consist in a general way of all influences that favor the coagulability of the blood, and of all depressing agencies which lead to a sluggish circulation. We may also note under this head certain blood changes, the true character of which is not yet understood, but which in some manner act on the venous walls and cause phlebitis, notably certain septic conditions. The puerperal state furnishes an example of a condition attended by abnormal coagulability of the blood, the formation of a clot in any given spot being the result of local causes. Such cases constitute what is generally known as *phlegmasia alba dolens*, or "milk-leg." Diseases of the heart and phthisis are good examples of conditions of depression playing the part of etiological factors in the production of phlebitis.

When the disease process begins in the walls of the vein itself some cause operates to roughen the internal coat, resulting in the formation of a coagulum at that point. The ultimate result is therefore the same as in the preceding case, only the formation of the thrombus is the secondary lesion.

In still another class of cases a severe inflammation invades certain tissues through which a vein passes. The vessel participates in the process, and again we have phlebitis occurring.

In no case is it likely that an inflammation is started in a vein and spreads throughout a great length, involving only its inner coat, and producing no thrombus. In septic cases, especially, the occlusion of the vessel must be regarded as a conservative process, for it effectually shuts off the diseased spot from the general circulation and prevents general infection.

Of great practical interest are those cases of phlebitis consecutive to influenza. Morlat and Rogier report a case in point in which the disease began suddenly in the calf of one leg, followed eight days later by involvement of its fellow, resulting one month later in gangrene and death.

As to the changes in the veins themselves, the outer wall is found to be principally affected, exhibiting increased vascularity and infiltration by inflammatory exudate. Thus the vessel itself is hardened, and when cut across, its lumen remains patulous instead of collapsing. The inner coat loses in glossy appearance and becomes dull and opaque. It is stained by the absorption of the coloring matter from the blood. Sometimes it is eroded, leaving the middle coat bare.

In some cases suppuration takes place. The inflammatory exudate in the venous walls may break down, forming an abscess in that situation, or the obstructing coagulum may be septic, the intima break down, pus form and be washed into the general circulation. The débris finds lodgment in other portions of the body, thereby starting fresh lesions. Sometimes the lodgment takes place in important vessels and produces sudden death, hemiplegia, etc.

In another class of cases granulations spring up on the inner surface of the vein, and mingle with the coagulum. The latter soon becomes organized. The tissue thus formed contracts, and the channel of the affected vessel is permanently obliterated. This condition is spoken of as *adhesive* or *obliterating phlebitis.*

In the most favorable cases, providing suppuration does not ensue, the calibre of the vein is ultimately restored, although the walls may remain more or less thickened.

Symptomatology.—The symptoms of phlebitis are those of a local inflammation *plus* obstructed venous circulation. Naturally the clinical picture differs according to the proximity of the affected vessel to the surface of the body. Thus if the vein is superficial and large, there will be observed subcutaneous œdema, and the affected vessel shows itself to the touch as a hard knotted cord. If a deep vein is involved, œdema is also present, but the infiltration is general, invading all parts below the vascular obstruction. The tissues are hard and brawny and do not pit readily on pressure. The tension is at times so great as of itself to constitute a source of extreme suffering. Under such circumstances it is hardly likely that the inflamed vein can be recognized by the sense of touch. When a vein having free anastomoses with others is involved,

the obstruction to the circulation may be so slight as to produce few symptomatic evidences of its existence.

Pain is always present. It is aggravated on pressure, and is especially marked along the course of the vein. It may be intermittent or continuous.

The limb may or may not be red; sometimes a red line marks the course of the inflamed vessel.

The temperature of the affected limb is nearly always elevated at first; later, as circulation becomes more and more interfered with, it becomes subnormal.

The constitutional symptoms consist of fever, rapid pulse, and sleeplessness. In severe cases, if prolonged, the clinical picture may simulate that of typhoid fever. Chills, sweats, etc., announce the onset of pyæmia.

Diagnosis.—Lymphangitis is the condition which is probably most frequently confounded with phlebitis. The former, however, nearly always arises from traumatism, and is accompanied by involvement of the tributary lymphatic glands. Lymphangitis comes on more suddenly than does phlebitis, and the inflammation tends to involve a network of vessels rather than a single one.

Phlebitis arising secondarily to a cellulitis may prove difficult of recognition. It is to be suspected when the veins below become unduly distended and there is œdema plainly not of inflammatory origin in those parts.

Prognosis.—The prognosis of phlebitis is, as a rule, favorable. Suppurative cases sometimes lead to general infection. In the majority of cases the collateral circulation is sufficiently well established to restore the normal circulation. In very few cases indeed is the circulatory obstruction permanent.

Treatment.—The first essential in the treatment of phlebitis is rest in bed. Care should be taken that the affected part is elevated, or at least not in a dependent position. It is important also to envelop the affected member in cotton-wool. When the temperature of the limb is high, iced applications bring considerable relief. If manipulation is to be tried, it must be very gentle lest a portion of the coagulum be detached and produce embolism.

The principal medicines for internal treatment are *aconite, arnica, pulsatilla, hamamelis, lachesis, hepar sulphur, lachesis. Belladonna* is suitable to cases in which the phlebitis is secondary to inflammation of contiguous structures and is indicated by the characteristics of that inflammation. Other remedies, as *rhus, cantharis, mercurius, sulphur*, etc., may be employed in individual cases for like reasons. *Arnica* is useful only in the mild cases, especially if the result of traumatism, and associated with bruised sore pains. Ecchymoses afford an indication for this drug.

Pulsatilla and *hamamelis* have a special affinity for the venous system

and both remedies have been much used empirically in the treatment of phlebitis, especially in that variety which occurs during the puerperium. *Hepar* produces good results in cases threatening suppurative changes. This remedy enjoys a most excellent reputation among many old school physicians. *Lachesis, arsenicum* and *baptisia* are adapted to cases with profound adynamia.

DILATATION OF THE VEINS.

Synonyms.—Varicose veins; varices; phlebectasia.

Etiology.—The causes of varicose veins are twofold: (1) Causes operating to weaken the walls of these vessels; (2) those increasing the intravenous pressure. Under the first head are included the degenerative changes incident to advancing years, and the weakened condition produced by debilitated states generally; under the second, gravity and lesions which retard the flow of blood through the veins. The veins of the lower extremities are especially liable to this affection, because in them the column of blood sustained by their walls is always greater than in any other portion of the body. Especially is this cause active in persons whose occupations necessitate a standing position most of the day. Heart diseases constitute an important and a much neglected cause, The lesion especially active in this respect is tricuspid insufficiency, which generally leads to dilatation of the veins emptying into the superior vena cava. In many cases the venous obstruction is local, as is evidenced in varices caused by pregnancy, cirrhosis of the liver, intra-pelvic and intra-abdominal tumors, fæcal impactions in the sigmoid flexure, tight garters, and thrombosis. Dilatation of the pulmonary vein and its branches occurs in mitral disease.

Morbid Anatomy.—The superficial veins are more liable to this lesion than are those deeply situated, probably because the latter are better supported by the surrounding tissues. As a rule the dilatation is not equally great throughout the course of the affected vessel. Sometimes it is manifested through the entire circumference of the vein, while in others it takes the form of a bulging on one side of the vessel. In either case, the enlargement is especially prone to take place just above one of the valves. Lesions in such a situation render the valves incompetent to close, deprive the circulation of this aid to the onward passage of the blood, and still further increase the difficulty. When the trouble is well advanced, the affected vessels increase also in length, and thereby become tortuous, and may form large subcutaneous bunches, which have not inaptly been compared to a "bunch of earth-worms" in appearance.

The walls of the veins undergo important changes. The muscular coat becomes thickened. Sometimes the entire venous wall undergoes

fatty or calcareous degeneration. In acute cases the changes take place so rapidly that the walls are thinned and tend to early rupture. When the dilatation is extreme, the circulation in the affected parts may become so sluggish as to lead to thrombosis.

Symptomatology.—The dilated condition of the veins as above described is manifest on inspection. The tributary parts are not infrequently œdematous. Pain is sometimes present and assumes a dull aching or sore character. The poor circulation of the parts naturally leads to impaired nutrition, which shows itself by local inflammations of a low grade and ulcerations. Sometimes, instead of the latter there are eczematous eruptions on the affected member.

Treatment.—The indications in the treatment of varicose veins are improvement of the general health and the removal of all sources of increased intravenous pressure. The first mentioned is met by rigid attention to all hygienic details, making the adoption of means designed to improve nutrition of special importance. The primary pathological condition in each individual case calls for proper treatment. Pressure must be removed from the veins involved. This may be done to a certain extent by keeping the affected limbs in a dependent position as little as possible, and by the use of apparatus making equable pressure over the dilated veins. For this purpose, the elastic stocking, or better still the rubber bandage, is necessary. Internally *arnica, pulsatilla, hamamelis,* and *rhus* are the most important remedies. Should hæmorrhage ensue from rupture of one of the dilated vessels, it is best controlled by local pressure.

Diseases of the Mediastinum.

The detection of the presence and character of new growths in this region is a most important subject for study. New growths in the mediastinum may vary much in character. Some authors state that lymphoma or lympho-sarcoma is the most frequent form; but Hare, in his prize essay presented to the Medical Society of London, states that out of 520 cases of disease of the mediastinum, 134 were cancers and 98 sarcomata. Aside from these growths, fibromata, hydatid cysts, dermoid cysts, lipomata, gummata and enchondromata are met. According to Eichhorst, mediastinal growths are about twice as frequent in men as in women and are especially apt to develop in early adult life. Abscess of this space may also cause many of the symptoms of a new growth.

In considering symptoms as well as signs, the close relationship of the growths to the large vessels, air tubes and œsophagus must be remembered. Simple inflammatory enlargement of the bronchial glands, which may terminate in abscess in rare cases, is a common attendant upon bronchitis, especially the bronchitis accompanying specific diseases. The degree of enlargement of these glands may be considerable. They are often gorged with blood, œdematous and infiltrated. Chronic enlargements may occur as a feature of leucocythæmia and Hodgkin's disease. Some assert that they may be detected beneath the upper portion of the sternum and high up between the scapulæ, occupying especially the posterior portion of the mediastinum; and being obscured by the spinal column behind, upon which they lie, it seems improbable that physical methods can detect them unless lateral pressure upon the lung is sufficient to give rise to signs, or the size of the tumor leads to prominence, dulness, or displacement of adjacent organs. Suppuration is usually a result of tubercular infiltration. The resulting pus may rupture the glands and perforate adjacent organs. Ordinarily the liquid portion undergoes absorption, the remaining cheesy mass becoming calcified.

Symptoms. The essential symptoms are the result of pressure upon adjacent structures. Evidences of compression may be manifested by the large vessels of the region, especially the innominate veins, the arterial trunks offering greater resistance. One or both of these veins may become occluded. The growth may perforate the walls of the veins and proliferate within. The symptoms of obstructed circulation will be uni- or bilateral, and consist of œdema of the neck, face and

upper extremity. Should the subclavian vein only be involved, the symptoms will be confined to the arm. There may be prominence of the subcutaneous veins, coolness and livid appearance of the surface. When the arterial vessels are pressed upon, the resulting stenosis develops murmurs which may be heard according to the site of the tumor, along the first portion of the aorta or pulmonary artery, or both, and posteriorly in a line with the spinal column. Tumors may displace the heart downward and leftward when in the anterior mediastinum, and forward with resulting increased area of pulsation when located posteriorly. The trachea may be compressed, and one or both recurrent laryngeal nerves paralyzed from pressure. The laryngoscope then reveals paralysis of the vocal cords, a full description of which may be found in the chapter devoted to affections of the pneumogastric nerves. Pressure upon the lungs may be sufficient to produce dangerous suffocative attacks. The lung parenchyma or bronchi may be invaded by the proliferation of the new growth. Cough is often annoying. The sputum may be bloody. Hæmorrhages even may occur. If the pneumogastric nerve is involved, the heart's action is slowed and irregular, or it may, on the other hand, become exceedingly rapid. Pressure upon the cervical sympathetic is suggested by pupillary changes. There may be contracted or dilated pupils, or one dilated and one contracted. Simulation of exophthalmic goitre has been observed. Swallowing may be difficult from pressure upon the œsophagus, as well as from paralysis of the epiglottis, due to involvement of the recurrent laryngeal nerve. If the latter condition exists, food may enter the larynx, be inhaled into the lungs, eventuating in pneumonia and gangrenous processes. With increasing pressure the chest wall may bulge. Erosion of the sternum has resulted in the appearance of the growth externally.

There is a certain amount of localized pain back of the sternum, and this is apt to be aggravated by muscular effort. Spinal pain suggests pressure upon the spinal column or involvement of the same in the morbid growth. When this symptom is pronounced and progressive, paralysis may follow. Neuralgic pains at a distance may be due to pressure from metastatic tumors. There may be various symptoms relating to sight, hearing, etc., or most serious disturbance of the cerebral circulation. The patient's general condition depends upon the nature and extent of the mediastinal growth. Anæmia is often pronounced, and a cachectic condition may be more or less rapidly developed. Towards the end, loss of flesh and strength is marked. The duration of the case is from a few weeks to several years.

Diagnosis. The presence of mediastinal tumors cannot be determined unless large enough to exert pressure upon surrounding tissues. Symptoms of this character have been sufficiently referred to. Mediastinal tumors of sufficient size to develop dulness upon percussion

may be mistaken for aneurism of the aorta or even pericarditis. From aneurism the separation may be difficult or impossible, as the symptoms of both are mainly due to pressure, and consequently are similar. The duration of tumor cases is much less than that of aneurism, and a strong suspicion that the disease is the latter may be indulged after a year or eighteen months. Osler emphasizes the diastolic shock which is often felt and sometimes heard over the aneurismal sac. Pulsating tumors simply rise and fall. The impulse is sudden, while the aneurism expands. A careful consideration of the history of the case, the irregular shape of the dull area, and the position of the heart's impulse in relationship to the dulness, will suffice for differentiation from pericarditis. When difficult deglutition is a prominent symptom, an exploration of the œsophagus may be required to exclude œsophageal cancer. Adherent particles may be examined microscopically, as they may be portions of the tumor.

Inflammation and Abscess.—Inflammation with, in acute cases, suppuration, and sometimes in chronic cases, inspissation of the pus, attacks the connective tissue of the mediastinum as the result of extension from neighboring tissues (secondary form), or follows cold, traumatism, etc. (primary form). Collections of pus may perforate an intercostal space, discharging externally, or burrow and perforate in any direction internally. Discharges into the abdomen through the diaphragm, into the pericardium, œsophagus or trachea, have been reported. A diffused suppuration has been described. In the chronic form, hyperplasia of the connective tissue is followed by cicatricial developments, with subsequent contraction.

Symptoms. In the acute form the local symptoms, which consist of pain, pressure, tenderness, are more pronounced beneath the sternum, or posteriorly, according to the location of the inflammation. The evidences of inflammation may be present even in the integuments. There is often disturbance of the heart's action, dyspnœa, difficult deglutition, cough and expectoration of blood-tinged mucus. If abscess develops the symptoms are similar to those present in tumor, *i. e.*, pressure symptoms. There will be dulness in an area which may in front extend laterally beyond the sternum. If pressure is sufficient there will be evidences of obstructed circulation and difficult swallowing. The general symptoms are few—chill, miserableness, anxiety, etc. The abscess generally ruptures internally, the nature of the subsequent symptoms depending much upon the organ involved in the rupture. Very sudden death may occur from erosion of large vessels.

Treatment is not very effective and must be mainly symptomatic. If the integuments manifest evidences of inflammation, pus must be carefully searched for with the aspirator and evacuated, or an incision made under antiseptic precautions. Trephining of the sternum may be necessary.

Diseases of the Nose.

THE EXAMINATION OF THE NASAL PASSAGES.

Anterior Rhinoscopy.—While the anterior portion of the nasal passages may be inspected by simply elevating the tip of the nose, such a procedure is entirely inadequate for giving a correct idea of the condition of any other than the most anterior part. For thorough examination it is necessary to make use of light carefully reflected into the passages by a mirror and a properly constructed speculum. The source of light best adapted to the uses of the rhinologist is artificial, furnished either by oil, gas or electricity. Probably the best is a good argand burner attached to a movable gas bracket, such as is sold in all the instrument stores for this particular purpose. To direct the light into the nose, a concave mirror, having a focal distance of twelve or fourteen inches, is to be used. It should have a small perforation in the centre and be attached by a universal joint to a head-band, so that it can be worn on the head when in use. Some physicians prefer to support the mirror on the nose by heavy spectacle frames, and others by a spring extending over the top of the head; while still others announce their preference for a mirror affixed to a handle.

Some operators give elaborate directions as to the kind of chair on which to seat the patient. Practical experience will soon teach one that it is best not to rely upon any special chair for ordinary work, but rather to accustom one's self to any kind that happens to be at hand.



Fig. 18.—Bivalve Speculum.

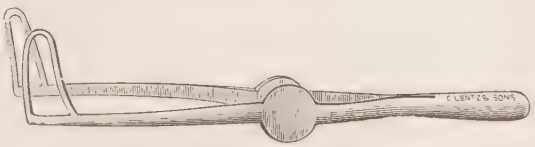


Fig. 19.—Bosworth Speculum.

The specula employed are simple instruments, which serve to dilate the anterior nares. They are of two kinds: the self-retaining and the bivalve. Each kind finds its particular uses, and should be in the possession of every physician. Of the former, those of Bosworth and Ivins are unquestionably the best; they are simple, cheap, and easily kept clean. Of the bivalve specula, a modification of Kramer's is the only one in common use.

Method of Performing Anterior Rhinoscopy.—Anterior rhinoscopy is the examination of the nasal passages *via* the anterior nares. The patient and operator seated, the latter with the reflecting mirror on the head, adjusts the light on a level with the patient's ear, arranging the mirror so that the light is reflected into the nose. The next step is elevation of the tip of the nose and inspection of the nares. The speculum is now inserted, and the patient directed to depress the head or bring the chin down a little towards the chest, when the different portions of the nasal cavity may be inspected. Attention should be directed to the following points:

The presence of secretion, its character and location.

The condition of the septum narium, noting its position, the presence or absence of enlargements and ulcerations thereon, and the appearance of its mucous membrane.

The appearance of the floor and inferior meatus.

The size, shape, color and consistence of the inferior turbinated body.

The appearance of the middle meatus.

The size, shape, color and consistence of the middle turbinated body.

The size, shape, color and consistence of the superior turbinated body, when such is possible.

In all cases it is important to inspect the parts thoroughly both before and after careful cleansing. Cocaine should not be resorted to for purposes of obviating the irritation incidental to the manipulations necessitated by examination, because it renders the discovery of sensitive spots impossible, and causes great alteration in the vascularity of the parts. Later it may be used as an aid to diagnosis in enabling us to recognize the presence of actual hypertrophy of the turbinated bodies.

The septum narium should be vertical in position and so placed as to make both nasal cavities of the same size. This normal standard rarely exists, deviation to one side or the other being a common phenomenon. In the majority of patients there will be found on the septum opposite the middle turbinated body, a small prominence which has been called the tuberculum septi.

The inferior meatus is the lowermost portion of the nasal passages, and is bounded above by the inferior turbinated body. It is into this meatus that the nasal duct empties, which explains the necessity for treatment of the nose in some affections of the eyes.

The inferior turbinated body appears as a pale red projection on the outer wall of the nose, the anterior portion of which only is to be seen by anterior rhinoscopy. It should never project so far as to come in contact with the septum.

Above the inferior turbinated body, separating it from the middle

turbinated, is the middle meatus, into which the canals from the frontal sinus, the anterior ethmoidal and the sphenoidal cells, and the antrum of Highmore, open. These are not visible by rhinoscopy.

The middle turbinated is of a paler red than the inferior body, and the superior, when visible, is found still more so. The density of the turbinates may be readily determined by manipulations with a dull-pointed silver probe.

Posterior Rhinoscopy.—This is a far more difficult procedure than the one just described. Considerable practice and skill in diagnostic technique is necessary to its successful application. By posterior rhinoscopy is understood the examination of the posterior nares by means of a mirror held in the pharynx at a proper angle. The same source of light and head mirror are used as before. The patient opens his mouth to the fullest extent, the light is reflected into the throat, the tongue is depressed, and the rhinoscopic mirror introduced.

The difficulties encountered arise from the inability of the patient to keep his tongue from arching upwards and thus interfering with the introduction of the mirror into the pharynx, and the elevation of the palate preventing a view of the post-nasal space. Both difficulties may be surmounted by a little care and patience. In depressing the tongue a depressor of proper size must be used. It must not be too large or it will press the edges of the tongue against the teeth and cause pain; it must not be carried too far back or it will excite gagging. If the tongue resists the pressure and persists in rising, the difficulty may readily be surmounted by a few seconds of steady, gentle pressure. The drawing up of the palate is to be prevented by having the patient breathe through the nose; or, if this fails, ask for the articulation of the word "hang." Sometimes even this fails, or the space between the soft palate and the posterior wall of the pharynx is too shallow for the introduction of the mirror. If so, the palate may be drawn forward by palate retractors designed for this purpose, or it may be held forward by means of rubber tubes passed through the nasal passages and brought outward by the mouth.

The rhinoscopic mirror consists of a small mirror of from three-fourths to one-half inch in diameter, and attached to a handle at an angle of from 100° to 130°. Many special designs of this instrument are so constructed as to permit of the setting of the mirror at various angles, the alterations being possible with the instrument *in situ*. Before introducing the mirror it should be warmed over the gas-flame, to prevent the condensation of moisture on its reflecting surface. Care should be taken that it is not too hot by first trying it on one's hand. It is then held in the hand like a pen, and inserted into the pharynx with its reflecting surface uppermost, a little to one side of the uvula. It must not be permitted to touch either the tongue or posterior wall of the pharynx or it

will excite gagging. Sometimes the parts are intolerant of the presence of the mirror, in which case the local irritability may be controlled by the application of cocaine. It is best to begin by holding the reflecting mirror nearly horizontal, thus obtaining a view of the vault of the pharynx, which appears as a smooth, round dome with a pale red mucous membrane. Tilting the mirror so that its surface looks somewhat forward, the posterior nares come into view. The septum is seen, and is broad above, tapering below. On the outer wall of each side are seen the middle and inferior turbinates presenting a pale red color. It is possible also to see the superior turbinated bodies. The openings of the Eustachian tubes are seen upon either side, bounded by the salpingo-palatine and the salpingo-pharyngeal folds.

The changes to be observed are alterations in the appearance of the mucous membrane, the character of the secretion, the presence or absence of hypertrophies, tumors, etc.

The more common symptoms of nasal disease are obstruction to nasal breathing, secretion, which may be watery, mucous, muco-purulent, bland or corrosive, bloody, membranous, or fœtid, and sneezing. The relative value of these in clinical work will be considered in the following pages, treating of a few of the individual diseases of the nose.

ACUTE NASAL CATARRH.

Synonyms.—Acute rhinitis; acute coryza; cold in the head.

Definition.—Acute nasal catarrh or acute coryza is an acute catarrhal inflammation of the nasal mucous membrane, which is usually excited by cold, but which there appears to be reason to believe is due essentially to the action of micro-organisms.

Etiology.—Acute nasal catarrh may develop either as a primary or as a secondary disorder. As the latter, it is one of the ordinary phenomena of influenza and measles. As a primary affection it develops suddenly, and can then be attributed to exposure to cold, as in getting wet, and to damp cold weather, especially when fatigued or overheated. Many persons exhibit a marked tendency to this annoying affection, and in spite of the best hygienic measures, suffer from several attacks during the cold months of the year. That exposure to cold is not the sole factor in its causation is demonstrated by the fact which the writer has frequently verified, that susceptible persons are often free from this annoyance in regions much colder than those to which they had previously been accustomed, and that, too, notwithstanding greatly increased exposure to the influence of cold. Children seem especially predisposed, their predisposition being furthermore increased by gastro-intestinal irritation.

It seems probable that acute coryza is due to the action of micro-organisms, of which there may be a variety, upon a mucous membrane

rendered susceptible by a lowered state of tissue nutrition, which nutritive disturbance seems to be, in a measure at least, excited in our climate by dwelling in apartments too much heated and insufficiently ventilated. The attack of acute catarrh is immediately excited by congestive changes due to exposure to cold. Chronic changes in the nasal cavities and post-nasal space are quite frequently the favorable soil upon which acute coryza develops. The tendency to recurrence of these attacks is often broken by the removal of the above-mentioned chronic conditions.

Acute nasal catarrh at times seems to occur in epidemics, which are prone to appear in cold, damp, changeable weather. Sometimes it attacks an entire household. It is in some instances apparently mildly contagious and can probably be transmitted by the discharges on handkerchiefs.

A transient coryza sometimes occurs from exposure to mechanical or chemical irritants, as a dust-laden atmosphere, and the fumes of chlorine, bromine, etc. Persons taking iodide of potassium in large doses frequently have coryza as a symptom of the physiological action of the drug.

Pathology and Morbid Anatomy.—The nasal mucous membrane and underlying tissues constitute the site of more or less intense congestion; especially are these changes found in the parts overlying the turbinated bones. The nasal passages are more or less obstructed by the consequent swelling and discharge. During the early days of the "cold" the discharge is watery, and, not infrequently, free and excoriating. Within two days the discharge usually becomes turbid and gradually thickens and darkens in color. The discharge diminishes and disappears in from six to ten days; or, by reason of certain causes, it may continue indefinitely.

Symptomatology.—An attack of acute nasal catarrh usually begins with sneezing, accompanied by dryness and more or less obstruction of the nasal passages. An examination of the parts shows the tissues to be swollen and more or less inflamed. The patient is often obliged to breathe through the mouth. The sense of smell, and very often that of taste also, is impaired or even destroyed. The voice assumes a peculiar nasal twang. The dry stage of the disease may be omitted, in which case the first symptom to appear is a watery nasal discharge. This is often of a highly irritating character, excoriating the portions of the skin with which it comes in contact. After two or three days the coryza undergoes the changes already detailed.

The associated symptoms vary considerably in different cases. Chilliness, slight elevation of temperature, headache, quick pulse, general muscular pains, rawness of the throat, post-nasal irritation and discharge, anorexia, constipation, and scanty, high-colored urine, are the most important. The severity of the affection varies from an attack so mild

as to merely attract attention, to one which compels the patient to go to bed. The duration of the acute symptoms is rarely longer than a week.

Sometimes the inflammatory process extends to neighboring parts. The frontal sinuses may be involved, leading to retention of discharges and the advent of numerous distressing symptoms, as frontal headache, facial pains, complete loss of appetite and sleeplessness. Sometimes the inflammation travels through the tear ducts and the conjunctivæ become inflamed. In others the Eustachian tubes are involved; pains shoot into the ears and deafness becomes an important feature of the case. Acute otitis media may occur and complicate the case. The usual extension, however, is to the pharynx, larynx and bronchi, "cold in the head" being a frequent precursor to "cold on the chest."

Diagnosis.—Coryza is to be differentiated from influenza by the epidemic prevalence of the latter, its higher temperature and greater amount of pain and physical prostration. A differentiation is not always possible. In recurring coryza the nasal passages should be inspected to determine whether or not the attacks are secondary to some removable cause. Swelling of the turbinated bodies with a serous discharge and sneezing, occurs frequently in certain persons as a neurosis. Such cases are marked by the suddenness of the onset and disappearance of the symptoms. There is an absence of fever and other general symptoms of acute coryza, and but little tendency to the development of chronic catarrh, no matter how frequently the attacks may recur.

Prognosis.—Colds in the head are not dangerous, but tend to develop certain chronic nasal affections. There is with many people a strong tendency for the inflammatory process to spread downward to the bronchial tract. Frequent attacks suggest the existence of chronic nasal disease of some sort, or impaired nutrition, often both.

Treatment.—Recovery is much more rapid when the patient remains at rest in the house. If the attack is a severe one the bed should be prescribed for a few days.

For the attack, if seen in its incipiency, *gelsemium* is almost a specific. If it acts favorably, a person subject to coryza should always have this remedy at hand and have recourse to it upon the first appearance of symptoms. But a small percentage of cases fail to respond to its action. The dose should range from one to three drops of the tincture repeated hourly until the symptoms subside. The early administration of the medicine is necessary to success.

Aconite, belladonna and *cepa* are preferable in some cases, and are differentiated by their well-known symptoms. Cepa is less frequently successful than gelsemium, but a more reliable medicine for the *early* stage than is generally understood.

Camphor also often acts abortively if given early and frequently,

i. e., several drops of the tincture every hour. It is applicable to severe attacks occurring in feeble persons, attended by much chilliness, and by feebleness of the circulation.

If the attack is unchecked and passes to the stage of free muco-purulent secretion, the action of medicines is, as a rule, not very favorable, although symptoms are often modified by *pulsatilla*, *kali bichromicum* or *sulphur*. It is under these circumstances that spraying or irrigation of the nasal chambers with solutions of permanganate of potash, boric acid, or other germicidal remedies, is of so much value. If the secretion is not free, but obstruction from swelling is a prominent feature, *sticta*, *ammonium carb.*, *nux vomica* and *lycopodium* have given the best results. *Arsenicum* suits a class of feeble elderly persons, subjects of chronic disease, who debilitate rapidly. The discharge is watery and often irritating.

Cocaine, which has been so much used, cannot be too strongly condemned. While the congestion is promptly relieved, and the patient made more comfortable by its use, it brings about a secondary paresis of the vascular walls, and often tends to prolong the attack. I have known several persons, subject to attacks of coryza, who developed continuous catarrh after using cocaine indiscriminately for all their acute attacks. I have, however, several times used it for public speakers and singers, when it was important to secure prompt relief regardless of other results.

Menthol inhalations are far better than cocaine. This drug dissolved in albolene, in the proportion of twenty grains to the ounce, may be used in the form of a spray. Sprays of certain oils, such as albolene, benzoinol, liquid cosmoline, etc., are of themselves highly beneficial.

Preventive treatment consists in removing any chronic nasal or naso-pharyngeal affections which may exist, improving the nutrition by outdoor living, cold bathing and systematic exercises. A period of forced feeding, *i. e.*, giving large quantities of easily digested liquids, particularly milk in some form, often elevates the patient to a higher plane of nutrition and arrests the tendency to catarrhal attacks. Cod-liver oil and other fats are often useful.

CHRONIC NASAL CATARRH.

Synonyms.—Chronic coryza; chronic rhinitis, etc.

Etiology and Pathology.—Chronic catarrh of the nasal cavities is characterized by a persistent muco-purulent discharge from the nose. This condition must, however, be regarded as a symptom only, for clinical investigations teach that it is present in a variety of morbid conditions of the nasal cavities. It is necessary, therefore, in every case to make a thorough inspection of these parts by means of anterior and posterior rhinoscopy in order to determine the nature of the primary lesion. This may be (1) a simple chronic catarrhal inflammation; (2) a chronic

hypertrophic rhinitis; (3) atrophic rhinitis; (4) the presence of foreign bodies in the nasal passages; (5) ulcers, which may be specific in nature; or (6) necrosed bone.

(1) Simple Chronic Catarrhal Inflammation or Simple Chronic Rhinitis may result from cold, local irritants, etc., acting upon susceptible individuals. The mucous membrane, especially that portion covering the turbinated bodies, appears swollen, abnormally red, and covered with a muco-purulent secretion. The discharge is yellowish or greenish and may be either thin or thick in consistency. The nasal passages are more or less constantly obstructed. The sense of smell is but little affected. In subjects of this disease slight exposure is sufficient to excite attacks of acute coryza.

(2) Chronic Hypertrophic Rhinitis. In another class of cases inspection reveals hypertrophic thickening of the nasal tissues, especially those over the lower turbinated bodies, and occasionally of the adenoid tissues in the naso-pharynx. Microscopic examination of the diseased parts shows actual increase in the tissue elements. Developments of connective tissue are found in the mucous membrane and subjacent tissues, even the perichondrium and periosteum participating in the changes.

Chronic hypertrophic rhinitis is especially apt to arise from habitual exposure to cold and damp, dwelling in a damp atmosphere, insufficient clothing, the absence of sunlight and ventilation, and congenital nasal obstructions.

The most annoying symptoms of this form are the mucous or muco-purulent discharge and the obstruction to nasal respiration. The latter condition leads to the formation of the habit of mouth breathing. The latter, if developed early in life, as in children, impresses characteristic changes on the features of its victims by the necessarily continued breathing through the mouth. The obstruction to breathing is most noticeable during exertion, excitement, and during sleep. In infants at the breast, nursing is interfered with, so that the child takes insufficient nourishment, and develops a marasmic state. In the majority of patients the obstructed nasal breathing brings on secondary conditions. The air taken in through the mouth is not properly warmed, and there ensue pharyngitis, laryngitis, bronchitis and other disorders of the respiratory apparatus. The openings of the Eustachian tubes may be involved, leading to disturbances in hearing.

To determine whether the enlarged tissues of the nose result from simple congestion or from hypertrophy, a very simple expedient suffices; *i. e.*, a four per cent. solution of hydrochlorate of cocaine is applied lightly to the parts. If congested only, the vascular tissue contracts, the blood is expelled, and the tissues shrink. These changes do not take place, or in much less degree, if the enlargement is dependent upon connective tissue overgrowth. When presenting marked hypertrophy the inferior

turbinated body is irregularly lobular in its anterior portion, the posterior having a polypoid development. It is not always easy to distinguish between these posterior hypertrophies and mucous polypi.

(3) Atrophic Rhinitis. In this variety of rhinitis there exists a progressive wasting of the nasal tissues with resulting enlargement of the nasal chambers and accumulation of offensive secretions. It sometimes appears as a primary condition; and sometimes as an advanced stage of hypertrophic rhinitis. It seems to occur more frequently in women than in men, and in the young than those past the age of forty. Very many cases commence before the age of puberty. It often gives rise to a most offensive discharge, and hence has been called ozæna. Such a misapplication of titles is inadmissible; ozæna is not always present in atrophic rhinitis, and, moreover, is frequently a symptom of other affections, as nasal syphilis, caries of the nasal bones, etc. The secretions in atrophic rhinitis are of a grayish color, and often form dry crusts or clinkers in the nasal cavity. The stench to which they give rise is believed to be due to their retention and decomposition, and not to the action of any special micro-organism. Ulceration occasionally accompanies atrophic rhinitis.

(4) Foreign Bodies in the Nasal Cavities. That these should escape recognition for a length of time sufficient to set up chronic catarrhal changes seems somewhat remarkable; yet such is the fact. Children are very apt to poke shoe buttons, beans, beads and other substances into the nose and say nothing to their caretakers of the accident. The true state of affairs can only be discovered by a careful rhinoscopic examination. The presence of a foreign body is often not suspected until all the ordinary therapeutic measures have been employed and proved futile. Suspicion should be aroused when a chronic catarrh affects exclusively one nasal passage, the general constitutional condition of the child being excellent. In doubtful cases it is necessary to have recourse to an examination under an anæsthetic.

(5) Ulcerations give rise to no distinctive symptoms. They can only be recognized by rhinoscopic examination.

(6) Caries and Necrosis of the nasal bones are characterized by an offensive and persistent nasal discharge; the nature of the lesion may be recognized by inspection and gentle manipulation with a probe.

Prognosis.—Simple chronic rhinitis and hypertrophic catarrh, especially the former, are readily curable affections. Atrophic rhinitis is a very obstinate disease, nearly always incurable, although much may be done to mitigate the condition of the patient.

Treatment.—The principles of treatment are: (1) Cleanse and keep the nasal cavities clean. (2) Remove hypertrophied tissues. (3) Improve the general health of the patient. (4) Search for and improve general diathetic states, such as scrofula, gout, syphilis, etc.

(1) Cleansing of the Nasal Chambers is to be accomplished by means of douches, sprays, antiseptic powders, and in many cases by the forceps and cotton. It is best to avoid watery solutions when possible. Antiseptic agents are usually best applied by means of insufflation in the form of powders. For cleansing purposes solutions of salt or boric acid in warm water are very satisfactory. One grain of permanganate of potash may often be added to each pint of warm salt water with advantage. The preparation of permanganate of potash recommended by me in the chapter on diphtheria (Vol. I, p. 227) has been found most useful in controlling the fœtor of ozæna, and also exercises an excellent influence upon the disease. The importance of thoroughly cleansing the mucous membrane before making these applications must not be overlooked. In simple and hypertrophic catarrhs applications on alternate days of iodoglycerin (a mixture of one-fourth tincture of iodine and three-fourths glycerin) is very useful. Good results have of late been secured by dry packing the nasal chambers with various materials impregnated with antiseptics; sprays or the direct application of diluted peroxide of hydrogen are to be recommended in some torpid cases. Inspection sometimes reveals chronic ulcers or necrotic bone as the cause of the discharge and fœtor. The former requires cleanliness and stimulating applications; the latter surgical treatment.

(2) Removal of the Hypertrophied Tissue is best accomplished by the snare, chromic acid fused upon a probe, or the galvano-cautery. This treatment must be employed with the greatest discretion. Considerable benefit is experienced from their use. But rhinologists have carried these measures to excess, producing, as the result of their cauterizations, marked cicatricial changes and extensive destruction of the nasal secreting surface. Such a condition is worse than the original disease for the relief of which the physician was consulted.

(3) The Nutritive Standard of the patient may be elevated by living in light, airy apartments, exercising regularly in the open air, taking proper rest, the daily use of cold sponging, and a carefully selected diet.

(4) The Diathetic State should receive the treatment recommended in the sections of this work relating to the same.

Specific medication is of value. A large number of medicines have been recommended and do considerable good, but they can never take the place of proper cleansing of the nose and the general measures above suggested. In simple catarrh with profuse muco-purulent discharge, *pulsatilla, kali bichromicum, sulphur* and *hydrastis* in its various preparations, are especially valuable. *Iodide of arsenic* is often serviceable in delicate cachectic subjects.

Many of the cases of ozæna for which *aurum, nitric acid* and other remedies are recommended, need simply proper cleansing, the removal of dead bone, etc.

Calcarea, graphites, nitrate of sanguinaria, silica, iodide of potassium, and similar constitutional remedies, are occasionally indicated.

HAY FEVER.

Synonyms.—Catarrhus æstivus (Bostock, 1819, *Medico-Chirurg. Trans.*); autumnal catarrh (Wyman); coryza vaso-motoria (J. N. Mackenzie); rose-cold.

A variety of affections of the nasal mucous membranes, possessing clinical similarity, are known by the name of hay fever. The special features of this group are (1) a more or less intense hyperæmia of the nasal tissues, attended by obstruction of the nose and free watery discharge, which symptoms are not dependent upon an inflammatory state, but upon vaso-motor paresis; (2) annual recurrence of the attacks with remarkable periodicity.

Definition.—Hay fever is a peculiar catarrhal affection of the upper air passages recurring with marked periodicity once each year, and which appears to be dependent upon a condition of the nervous system which leads to a morbid sensitiveness of the nasal mucous membrane to the irritant influence of the pollen of various flowering plants, the time of development of the attack depending upon the variety of pollen for which the individual possesses a susceptibility.

History.—The term hay fever has been retained as the one most familiar to both the profession and laity, and perhaps as not less appropriate than most others proposed.

In recent years the disease has been much studied in America, and the subject has received valuable contributions by Wyman (1876), Beard (1876), Marsh (1877), and Daly (1882). Daly, Roe, J. N. Mackenzie and Harrison Allen especially, have called attention to the influence of structural alterations within the nose upon the production of the disease. Blackley, of England, demonstrated the exciting influence of the various pollens (1866).

Etiology.—While much has been learned of the nature of hay fever our knowledge still lacks definiteness. When the influence of pollen was demonstrated as the immediate excitant of the attack, it was hoped that the problem had been solved, and later, when it was shown especially by Daly, of Pittsburgh, that the disease was quite constantly associated with sensitive areas and structural lesions of the nasal mucous membrane, it seemed that better therapeutic results must be at hand, but the energetic measures directed to their removal have not materially improved our results. With the failure of the local treatment, and the gradual accumulation of evidence of implication of the nervous system, the neurotic theory of hay fever has become strongly advocated. Heredity exercises some influence, as it is not uncommon to treat several members of the same family. This has repeatedly occurred to the writer. Race, resi-

dence, or both, must possess importance, as hay fever prevails almost exclusively among Americans and English. Social position is a prominent factor, as shown by the fact that it is the educated neurotic upper classes which furnish the great majority of sufferers, which accounts for the frequency of this disease in cities. It develops at all ages. The predominance in males is large. The exciting cause was demonstrated by Blackley, an English homœopathist, to be the pollen of certain flowering plants. His elaborate and scientific experiments were begun in 1866 and continued with great persistence for more than twelve years. They are authoritative to-day, little or nothing having been added to them.

Clinical Course.—The symptoms of hay fever vary from those of a slight coryza to those of a severe rhinitis, with frequently an associated bronchitis or asthma, and in the primary development are practically the symptoms of a cold in the head. Premonitory symptoms are unusual. There is sneezing, with irritating sensations in the nose. The lining tissues of the nose swell, occluding the nasal passages, and causing breathing through the organ to be difficult or impossible. The early discharge is watery, alkaline, and usually excoriating to the cutaneous surface. Attending this group of nasal symptoms there may be lachrymation, itching, burning and redness of the eyelids, headache, itching in the roof of the mouth, tinnitus and loss of taste and smell. The symptoms of constitutional disturbance are not usually pronounced. With the continued development of the disease the nasal secretion becomes mucoid, then muco-purulent. To the inflamed eyelids may be added conjunctivitis, the eye symptoms being most distressing.

Asthma may develop at any period of the disease. Occasionally it is more prominent than the catarrhal symptoms, or it may replace them, and thus constitute the special or sole feature. Generally it follows quickly upon the establishment of the nasal symptoms, being preceded by various symptoms of irritation of the respiratory tract. Bronchitis, with an annoying cough and expectoration, is common. The symptoms of this "hay asthma" do not differ in any essential respect from those of the ordinary variety.

Time of Appearance. When occurring during May and June the disease is called "rose-cold," this being the milder variety. Those attacks developing during the latter part of August or the early days of September are called hay fever. The latter form continues until frost. In a limited number of cases the disease may develop at other periods of the year. J. N. Mackenzie developed an attack in one individual by presenting an artificial rose.

Diagnosis, Prognosis, etc.—The diagnosis of this periodical catarrh is usually easy. The nature of first attacks is often overlooked. It is therefore best to look with suspicion upon catarrhal attacks occurring during portions of the year in which hay fever develops. The co-exist-

ence of asthmatic symptoms is strongly suggestive, as are also the suddenness of the attack without constitutional symptoms, and the œdema of the eyelids. Early diagnosis is important as early treatment is sometimes effective. The generally unsatisfactory results of treatment are well known. Few cases are cured, but after years of continuance the disease has ceased spontaneously. This is more likely in the case with "rose-cold." It is seldom that an impairment of the general health occurs which can be attributed to the disease.

Treatment.—The search for *specifics* for hay fever is accountable for much of the ill-success attending the treatment of this affection. Thus far we are not encouraged to believe that they exist. The individual should be most carefully examined in relation to all the organs and the best plan devised for correcting any local or constitutional conditions with which the patient may be afflicted. In this manner I have been able to prevent the attacks in a number of cases. It should be considered a satisfactory result if the general health gradually improves (if it has been impaired), and the annual attacks of catarrh gradually diminish in intensity. Two to four years of such treatment may be recommended as likely to afford pronounced results.

Measures to improve neurotic constitutions and to remove local disease of the nose and naso-pharynx are the most important preventive measures. The use of chromic acid and the galvano-cautery is admissible for the removal of hypertrophies, but the destruction of sensitive areas by this means is falling into disrepute. Prevention of the attacks is best secured by removal of the patient from the influence of flowering plants. This is accomplished by a sea-voyage or a residence at certain sea-shore resorts where the disease is known not to develop. Often residents of the country are benefited by remaining in a large city during the period of danger, and city patients are sometimes free if they remain, without exception, in the city. Those who are unable to leave home may, when exposed, protect the eyes with properly constructed spectacles, and the nose may be plugged. In this manner the attack may be prevented or its severity diminished. A large number of remedies have been recommended, but it is only occasionally that one observes decided results.

Blackley recommended *iodide of zinc* as most important in doses of one two-hundredth of a grain. He also found benefit from the *arsenite of potash*, and the *arsenite of quinine*.

Arsenic undoubtedly possesses the greatest reputation, being generally given in the lower decimal dilutions. During the past few years I have been employing the *arsenite of copper* in the second decimal trituration with some satisfaction.

Iodide of arsenic is thought to be preferable, by some observers, when the nasal discharge is exceedingly acrid.

Iodide of potash presents a group of symptoms often met in neurotic catarrh and is clinically of decided value. Should the patient be a syphilitic the probability of its usefulness is increased.

Sticta often relieves cases in which there is a troublesome cough with hyperæthesia of the laryngo-tracheal mucous membrane. The cough is aggravated by pressure over the trachea, lying down, talking, and even breathing.

Dr. Bayes advocates *sabadilla*, a remedy we have found of some use when excessive sneezing is the most prominent symptom.

Dr. Beard strongly advocated *quinine* as the most efficient medicine.

Bosworth considers *belladonna* as exercising a more specific and thorough control of the disease than any other drug. He gives the medicine in large doses.

Terpine hydrate in doses of fifteen grains, given in capsules three or four times in the twenty-four hours, is recommended by L. A. Rixa, of New York. Germain See has demonstrated the absolute harmlessness of this drug, which is claimed to be highly curative.

Dr. Hughes says he never had success until he began the use of *Binz's solution of quinine.*

Feber, of Hamburg, recently observed in his own case that while at his worst, his ears were pale and cool, and that when relieved, they became flushed and warm. This observation suggested to him rubbing of the ears when in the former condition. If thoroughly performed, relief followed for a certain period of time. Persistence in the procedure has secured to him, as well as to several of his patients, marked moderation of their symptoms. This plan has now been used successfully by him for three years. Emphasis is laid upon the thoroughness of the rubbing.

Cocaine is not advised for reasons stated in the article on coryza.

In the form appearing early in the season—rose-cold—*Allium cepa, gelsemium, euphrasia,* and other medicines which are ordinarily employed for simple catarrhal inflammation, may be used with considerable success.

EPISTAXIS.

Synonym.—Nosebleed.

Definition.—Epistaxis is a term applied to hæmorrhage in which the bleeding takes place from some point within the nasal cavities. It must not be confounded with cases in which the hæmorrhage starts at some other point and escaping into the nose is expelled by the nostrils.

Etiology.—The great vascularity of the nasal mucous membrane, its exposure to numerous influences exciting hyperæmia, and its delicate structure, make epistaxis a very common symptom. It may result from changes in the nasal chambers or from general conditions. Of

the local causes, traumatisms of various kinds, as picking at the nose, blows, foreign bodies, and fractures at the base of the skull, are the most common. Nasal catarrh, growths of various kinds, and ulceration, may be cited as examples of local disease exciting it. In some cases of fracture at the base the bleeding really starts in the middle ear or one of the accessory sinuses, and escapes thence to the nasal cavities. I have repeatedly seen severe hæmorrhage due to rupture of a pulsating vessel upon the septum. Of general causes there may be mentioned blood changes, as in anæmia and plethora, the infectious fevers, vicarious menstruation, the suppression of a hæmorrhoidal flow, hæmophilia, and advanced kidney disease. The infectious diseases with which epistaxis is especially apt to be associated are eyrsipelas, typhoid fever, the malignant fevers generally, malarial fevers, and nasal diphtheria. Exposure to extremes of heat and cold is an occasional cause. The occurrence of epistaxis is so common during the first week of typhoid fever, that it has been regarded as possessing some diagnostic import. Epistaxis during nasal diphtheria is an exceedingly unfavorable symptom.

Epistaxis is quite common in delicate and rapidly-growing children, and also in those of a plethoric habit. It is less common than might be expected in circulatory obstruction due to cardiac or pulmonary disease. The rarefied atmosphere of high altitudes sometimes excites it.

All cases coming under the observation of the physician should be subjected to rhinoscopic examination, and in very many of these the causative lesion is discoverable, if the symptom arises from local causes. When, however, constitutional influences are at work, there may be seen a small surface from which the blood oozes, the mucous membrane being deeply congested.

Symptomatology.—Epistaxis may set in with or without premonitory symptoms. In the former case, and examples occurring thus are the exception, the appearance of the bleeding is preceded by vertigo, pressure in the head, dryness and tickling in the nasal fossæ, obstruction to nasal breathing, etc. In the majority it appears without warning, the blood escaping by the nostrils. When developed while the patient is asleep and lying on his back, or in comatose persons, the blood flows backwards into the pharynx and may be swallowed. Under these circumstances, if the hæmorrhage has been free, the first intimation of its occurrence may be vomiting of blood, or if in its backward flow it excites cough with expectoration of blood, hæmoptysis may be supposed to exist. Aside from the flow of blood the symptoms are dependent upon the amount of that fluid lost, and are consequently the same as in hæmorrhage from any other part of the body. It is rarely sufficiently great, however, to produce alarming symptoms. The flow is usually from but one nostril. As to whether the blood will escape through the anterior or posterior nares will depend very largely on the seat of lesion.

Prognosis.—Death from epistaxis is exceedingly rare. In the majority of cases the flow ceases within twenty minutes. The most dangerous ones occur in the course of hæmophilia, or from fracture of the skull.

Treatment.—When epistaxis results from general conditions of the blood or from visceral disease, treatment must be applied to the primary condition. In all cases rest of the parts is necessary. The patient must be kept quiet and abstain from breathing through the nostrils. He must carefully avoid any attempt at clearing the nose. Ice may be applied to the nose or to the nape of the neck. The nasal cavities should be carefully examined by the aid of the mirror, forceps and cotton. The writer once witnessed at the Pennsylvania Homœopathic Hospital for Children a case of epistaxis in a boy of fourteen, due to hæmophilia, who had been reduced to the last extremity by his loss of blood, relieved at once and permanently by Dr. Charles M. Thomas by means of pressure upon the point of hæmorrhage, which was easily seen and not larger than a pea. The nostrils had been repeatedly tamponed before admission to the hospital.

When ordinary measures fail to control the flow and the seat of bleeding is not to be reached, tamponing of the nasal cavity with iodoform gauze should be performed. All other measures failing, plugging of the posterior nares with the aid of Bellocq's canula or a simple soft catheter, is the last resource.

In the hæmorrhages of the young, attended by plethora or excitable circulation, *aconite*, *belladonna*, *ferrum phos.*, *calcarea carbonica*, and *veratrum viride* are most frequently employed and are of genuine service. In those occurring later in life, and which are usually attended by serious blood or tissue changes, such remedies as *crocus*, *china*, *crotalus*, *hamamelis*, *phosphorus* and *secale* should be considered.

I would call particular attention to *ferrum muriaticum* in the first decimal dilution or drop-doses of the tincture, for hæmorrhages occurring in association with fevers and other conditions characterized by blood deterioration; to *ferrum phosphoricum* for the recurring hæmorrhages of delicate children in whom local causes are not apparent; and *hydrastinine hydrochlorate* in the third decimal trituration for hæmorrhage of a serious character regardless of cause. No remedy is so generally useful.

Affections of the Larynx.

THE EXAMINATION OF THE LARYNX.

For the purpose of making an examination of the larynx, it is necessary to employ the ordinary head mirror described in the section devoted to the examination of the nose, laryngoscopes of various sizes, especially numbers three, four and five, also a napkin with which to hold the tongue.

The patient and examiner are seated as for a rhinoscopic examination, and the light is employed in the same manner as described for posterior rhinoscopy. Before introducing the laryngoscope, the pharynx should be examined to determine the size of mirror to be employed. The patient is instructed to throw the head slightly back and protrude the tongue, which the examiner grasps and steadies with the cloth held between the thumb and first finger of the left hand. The larnygoscope should next be heated by holding it over the gas-flame with the reflecting surface downward. A film of moisture is seen to collect and quickly disappear. After testing the mirror on the back of the hand to make sure that it is not too hot, the patient is instructed to breathe deeply through the mouth, while the laryngoscope, held in the right hand as one holds a pen, is introduced into the mouth with the reflecting surface downward, and in such a manner that the stem of the instrument is at the left corner of the mouth. Care must be taken not to touch the tongue or sides of the mouth. As the patient breathes the uvula is seen to rise. At this moment press the laryngoscope back against and rather under the uvula, allowing the lower edge of the mirror to press firmly, but not forcibly, against the posterior pharyngeal wall. The light being now reflected by the head mirror on to the laryngoscope, is, in turn, reflected into the larynx by that instrument, upon which is received the return image of the vocal box.

The first view gives a picture of the epiglottis standing out from the base of the tongue, on either side of which is observed an accumulation of follicular glands, known as the fourth or lingual tonsil. By depressing the mirror a little nearer to the horizontal, the interior of the larynx is illuminated. The epiglottis, occupying the uppermost position on the mirror, is seen to be attached to the base of the tongue by the median and two lateral glosso-epiglottic ligaments. The spaces between these ligaments are known as valleculæ, and are favorite places for the lodgment of foreign bodies. The epiglottis varies in shape in different individuals, being usually broad and folded backward, although it is frequently observed to

be folded upon itself, so that a lateral convexity presents upward. In color it is of a yellowish pink, the cartilage transmitting a yellowish cast through the thin mucous membrane. Below this yellow posterior surface is a bright red cushion, known as the "cushion of the epiglottis." Extending backward, downward and inward from either side of the epiglottis, are two folds of mucous membrane, the color being identical with that of the mucous membrane of the cheeks. As these folds extend from the epiglottis to the arytenoid cartilages, they are known as the ary-epiglottic folds. These folds form the upper lateral boundaries of the vocal box; at their posterior extremities they contain the cartilages of Santorini surmounting the arytenoid cartilages, and outside of these two little sesamoid cartilages are those of Wrisberg. During inspiration there may be seen a notch or space between the arytenoid cartilages, known as the inter-arytenoid space; during phonation, while the arytenoids are approximated, this space is nearly or quite obliterated, the mucous membrane covering the part being thrown into folds.

Immediately below the cushion of the epiglottis is the anterior commissure of the vocal cords, which appear as two pearly white bands extending to the arytenoid cartilages. During phonation they appear to be in contact throughout their entire length. A little yellow spot near the posterior extremity of each cord indicates the junction between the ligamentous portion in front and the vocal processes behind. During respiration they assume a V shape on account of the separation of their posterior extremities. External to each vocal cord and situated between these structures and the ary-epiglottic folds and running parallel to the vocal cords, are two folds of mucous membrane, known as the ventricular bands or false cords. Between the ventricular bands and vocal cords are the ventricles of Morgagni. External to the larynx on either side, we find the sinus pyriformis or hyoid fossa, in which foreign bodies frequently lodge.

By having the patient breathe deeply and throwing the light between the vocal cords, one is enabled to view the rings of the trachea, and occasionally to inspect its bifurcation into the primitive bronchi.

There are a number of impediments to a successful examination of the larynx, most of these being easily overcome by the careful operator. Hyperæsthesia of the pharynx is usually due to awkwardness on the part of the examiner. When this is not the case an application of a four per cent. solution of cocaine to the parts usually overcomes the difficulty. When hypertrophied tonsils are so large as to interfere with the examination, their removal is generally indicated. When the patient holds the breath, a little instruction as to the nature of the examination is usually sufficient. An overhanging epiglottis is one of the most frequent hindrances to a view of the interior of the larynx, but if the patient is instructed to say "eh," the epiglottis rises, exposing the interior of the

larynx. When this fails, an application of cocaine may be made to the epiglottis, upon its glottic surface, which will enable the operator to hold this valve against the base of the tongue with a laryngeal probe.

When the arch of the tongue rises too high in the mouth, or the patient's tongue is tied, a tongue depressor is essential.

ACUTE CATARRHAL LARYNGITIS.

Synonym.—Acute laryngeal catarrh.

Definition.—An acute inflammation of the mucous membrane of the larynx.

Etiology.—Acute laryngitis arises in a majority of cases from exposure to cold in a variety of ways. Thus it may originate from a draught of air, from getting the feet wet, from chilling of the surface of the body, etc. Acquired or family predisposition is often an important factor. It is not very uncommon to observe families in whom even a slight exposure of any kind is sufficient to excite this disease. We also note a tendency to it in children and others who are confined in poorly ventilated rooms, who are overclad, and who contract the disease on going out of doors in any other than mild weather.

Mechanical causes are operative in many instances. Thus acute laryngitis may set in after excessive or violent use of the voice in public speaking or from violent paroxysms of coughing. The inhalation of irritating vapors, as those of chlorine, bromine, and tobacco, and exposure to a dust-laden atmosphere is responsible for many cases. Sometimes it is produced by traumatism, as from foreign bodies, and the swallowing of corrosive poisons.

The influence of a sedentary life and the breathing of a bad atmosphere, as a predisposing cause, is exhibited by the frequency with which such tradesmen as shoemakers, tailors, etc., are attacked, while those whose occupations keep them constantly out of doors in all kinds of weather remain comparatively exempt.

As a secondary affection acute laryngitis is observed during the course of influenza, erysipelas, measles and other diseases, especially those of an infectious nature. It occurs most frequently perhaps as a feature of a general catarrh of the respiratory passages, by extension from the naso-pharynx on the one hand, and the trachea and bronchi on the other.

Symptomatology.—The first symptoms manifested consist of a dryness of the throat and huskiness of the voice, the latter increasing in well-marked cases to complete aphonia. There occurs early a tickling in the throat, which produces a dry, teazing cough, aggravated by talking or the inhalation of cool air. Pain is rarely a prominent symptom. Still it is sometimes experienced to a slight degree, being especially noticeable after use of the voice or in the cold air. Manipulation of the larynx from

without may show some tenderness; but spontaneous pain is seldom experienced. As the disease progresses the cough becomes of hoarse character, and may be attended by a scanty expectoration of muco-purulent character. The patient may be unable to speak above a whisper. The alterations in the voice are caused in the first place by the swelling of the vocal cords, and secondly by impaired movements of the cords resulting from inflammatory infiltration of their substance. Respiration is rarely interfered with excepting in children, quite considerable swelling being possible in adults without causing dyspnœa. Fever is sometimes present, but is usually slight.

The morbid changes present are determined by the use of the laryngoscope, and are those of a more or less active catarrh. Varying degrees of redness and swelling of the laryngeal mucous membrane, especially that covering the vocal bands, both true and false, and of the ary-epiglottidian folds may be seen. There is more or less mucus visible, and in severe cases patches of superficial erosion and hæmorrhagic foci may exist. The inflammatory changes are variously distributed in different cases. Patches of grayish-white suggesting thickened epithelium are present. The congested thyro-arytenoid muscles may be paretic, resulting in incomplete closure of the glottis during phonation. Varying degrees of hoarseness, cough, and laryngeal irritation in the form of tickling and itching are experienced.

Diagnosis.—The diagnostic problems relate to the detection of coexisting œdema of the larynx, a most serious though fortunately rare attendant upon this disease, and to the separation of the catarrhal affection from other varieties, such as pseudo-membranous laryngitis and the inflammation secondary to measles, influenza, etc. The presence of fever and catarrhal symptoms eliminates laryngismus stridulus. Membranous laryngitis may be differentiated from the catarrhal disease by the greater constitutional depression and the presence of enlarged cervical lymphatics.

Prognosis.—The prognosis of acute laryngeal catarrh is rarely unfavorable in adults, unless marked œdema occurs, or the disease is associated with serious general affections. Under proper treatment it subsides in from three days to a week. Neglected cases may develop into the chronic disorder.

Catarrhal Croup.—A variety of acute laryngitis occurring in children demands special mention. It is known as catarrhal croup, spasmodic croup, or false croup. The distinctive peculiarities of this affection are: (1) Its occurrence almost exclusively in infants and young children. (2) The association of spasm of the constrictor muscles of the larynx. (3) The tendency to nocturnal exacerbation.

The peculiarities of catarrhal croup may be traced in considerable degree to the structure of the child's larynx, and to the sensitiveness of the infantile nervous organism. The larynx is relatively small, the

glottis narrow, and the mucous membrane highly vascular and loosely connected to the subjacent tissues. The frequency with which croup occurs in children has been given another explanation by Bosworth. Directing attention to the richness of the laryngeal mucous membrane in lymphatic structures, and the frequency with which these are the seat of disease in subglottic laryngitis, he looks upon croup as symptomatic of lymphatism.

In catarrhal croup the vocal bands are swollen into thickened bodies and vibrate feebly, thus giving rise to the peculiar "croupy cough." As the changes in the larynx progress the cough becomes feebler and wheezy. The inflammation involves primarily the mucous membrane and, in aggravated cases, the submucous tissues, the spaces of which become filled with a serous or serofibrinous fluid. It is this œdematous state which leads to stenosis. The mucous surface is at first dry and red, and then covered with mucus. The intensity of the inflammatory process may be much greater in some portions of the larynx than in others. This fact affects the character of the symptoms. For instance, when subglottic, a high degree of dyspnœa and other symptoms of stenosis may be present, but the voice remains comparatively clear. Obstruction usually occurs at that portion of the air-tube bounded by the cricoid cartilage, this being the most constricted portion.

The symptoms may be divided into those of the exacerbation and those of the intermission. Following usually upon hoarseness and other slight symptoms of cold during the day, the child awakes from sleep with fever, croupy cough, oppression of the chest and restlessness. These may be extreme with clutching of surrounding objects for relief, and, if the child is old enough to develop them, anxiety and fear. The voice may be suppressed. After one to four or six or more hours, the attack diminishes (often with the advent of day) and relief is nearly or quite complete. Frequently cough is of a less croupy character, a little rise of temperature and the general symptoms of a cold continue during the day, to be again followed on the second night by a repetition of the previous night's experience. In severe attacks the intermission may be absent, the symptoms of the exacerbation continuing during the day. The nocturnal aggravations may continue for from four to five nights. If checked quite promptly, it is common for the croupy attack to be replaced by a catarrhal bronchitis, the catarrhal wave passing thus lightly over the larynx and spending its force, ultimately, upon the bronchial tubes. Lobular consolidations or collapse may be sequential to the bronchitis.

The PROGNOSIS OF CATARRHAL CROUP is, as a rule, favorable, but as dangerous symptoms are sometimes present, the expressed prognosis should be guarded.

The CAUSES are those of acute laryngeal catarrh, especially exposure to

damp and cold. Traumatic cases occur, especially among the poor, who are often compelled to leave their children without proper supervision. Swallowing of irritating substances, the inhalation of steam, flames, and irritating fumes, are also frequent causes. The lips and mouth often bear evidence of the action of irritants, which suggest at once the nature of the cause. The prognosis of this class of cases is often unfavorable, owing to coexisting lesions of the mouth and stomach.

Treatment.—In children subject to catarrhal croup, much may be done to prevent attacks. Regulated out-door life, cool sponging, attention to nasal and naso-pharyngeal affections from which waves of catarrhal inflammation spread, avoidance of violent screaming, and especially a change to a climate in which the little patients can live out-doors for a winter or two, I have known to revolutionize the tendency. Patients of a scrofulous or lymphatic constitution require measures directed especially to that diathesis.

During an attack of acute laryngitis, rest of the larynx, and, in aggravated cases, rest in bed are essential. The atmosphere of the room should be kept at an even temperature, and, at times, may with advantage be saturated with steam. A cold pack to the larynx is often helpful, especially in the incipiency of the attack, and will, unaided, relieve many cases. Application of an ice-bag to the larynx is recommended. Some advise hot applications during the entire attack. When steam is used, it should be inhaled as freely as possible. Home-made devices for the conducting of the steam directly to the mouth of the patient are easily constructed. *Iodine, bromine, benzoin* or *eucalyptol* may occasionally be added to the boiling water with advantage.

It is best to begin the treatment of the attack with *aconite* in the lower dilutions, and repeat the doses frequently. The symptoms for this medicine are often present, and its influence is decided. It is often the only remedy needed in the croupy attacks of children. A few intercurrent doses of *iodine* or *bromine* may be called for. Fresh preparations of these latter remedies are necessary to secure success. *Spongia* is much advocated, but is less often valuable than either iodine or bromine. It is suggested by a dry, high-pitched "croupy cough." Occasionally *belladonna, hepar sulphur, kali bichromicum* or *phosphorus* may be indicated. *Belladonna* is called for when the child is hot, drowsy, perspiring and has a full, soft pulse; *hepar sulphur,* when there is a loose, rattling cough and a marked aggravation in the latter portion of the night; *kali bichr.* appears to be better suited to the laryngitis of adults with associated bronchial catarrh and the characteristic sputum. *Phosphorus* is also better adapted to the catarrhal laryngitis of adults than that of children.

The spasm of the glottis, which is often associated, is not unfrequently relieved by *sambucus* when it develops early and is a very pronounced symptom. It has generally been given as supplementary to aconite.

Benzoin 1x dilution has been highly lauded by Allen, of New York. His observations tend to show the great utility of this remedy in acute laryngitis when there is hoarseness, accompanied by a sensation of rawness extending from the larynx into the pit of the throat, but not further down. I have used the tincture on sugar with better results.

A degree of stenosis demanding intubation or tracheotomy may supervene, though but rarely.

CHRONIC CATARRHAL LARYNGITIS.

Etiology.—Chronic catarrhal laryngitis is as rare as the acute form is common. It may result from frequently repeated or neglected attacks of the acute form, or from the long-continued action of a variety of influences upon the larynx of a susceptible individual. Singers, public speakers, workers in irritating atmospheres, steady drinkers, syphilitics, and persons exposed to rapid temperature changes, are most frequently affected. As important as overuse is incorrect vocalization. Habitual mouth breathing is a frequent cause. Some observers hold the extreme view that a chronic laryngeal catarrh is always secondary to disease of the nose or naso-pharynx (Bosworth and Germain See); while others equally entitled to respect believe that primary catarrhal laryngitis is occasionally encountered. Chronic catarrhal laryngitis has been ascribed to more than fifty causative influences by a recent author.

Symptomatology.—In an apparently primary catarrhal laryngitis, the early symptoms are those of laryngeal irritation, *i. e.*, hoarseness, especially upon beginning to use the voice, tickling, itching, stiffness, or sense of something in the larynx leading to "hemming and hawking." With the progress of the disease hoarseness becomes more pronounced, but, strange to say, does not possess close relationship to the seriousness of the pathological changes, slight ones being often attended by marked hoarseness, and *vice versa*. This has been explained as due to changes in the vocal muscles, *i. e.*, to interfibrillar hyperplasia, to pressure upon the peripheral nerve filaments and to the location of the inflammation. There is little pain. In advanced stages the voice may be lost, or rough and discordant. Cough is variable in intensity, phonation is difficult, requiring more forcible expiration for its performance. The patient often complains of a sense of exhaustion referable to the chest and back, due to the over-working of the respiratory muscles necessitated by the more forcible respiratory effort.

In the œdematous and hypertrophic varieties respiration may become much embarassed. When ulceration occurs, which is rarely, it appears as superficial erosions, or as an ulceration of the mucous follicles, due probably to the friction of the true vocal bands, the ulcers usually appearing first upon the edges of these structures. From long-

lasting catarrh the cords may present a granular appearance, and hypertrophic new formations may lead to laryngeal stenosis.

Laryngoscopic Appearances.—There are many gradations in the objective phenomena, the interior of the larynx appearing more or less swollen, moderately red, or bluish red, in individual cases. The surface may be glazed by secretion, or there may be here and there patches or threads of mucus. The lesion may be patchy. Morrell Mackenzie states that but one cord may be involved, or even but a portion of one. The swelling may be confined in a marked degree to a small portion of the organ, more especially to the vocal cords. The cords and much of the surface may present a granular appearance or hæmorrhagic foci. Vocalization may fail to properly approximate the vocal bands. This is due to paretic muscles or to a swelling of the inter-arytenoid tissues which forms a convex prominence even when the arytenoids are widely separated. Polypoid growths are not uncommon as a sequence of chronic catarrh. The mucous glands are often enlarged and can be localized by their more prominent orifices. Chronic thickenings often result, involving the epiglottis, the ary-epiglottic folds and the false cords.

Simple chronic laryngitis usually pursues an exceedingly chronic course, which is largely due to neglect and exposure upon the part of the patient. This disregard of self-interest is largely the result of the fact that the disease in its earlier stages does not often incapacitate the patient from pursuing his ordinary habits. Inefficient treatment must also often bear a portion of the blame. Many cases recover under early and efficient management.

The very frequent association of chronic laryngitis with disease of the naso-pharynx demands that the latter region should be inspected in all cases.

Chronic laryngitis may be succeeded by sequelæ. The most likely of its pernicious results are tubercular degeneration and the formation of malignant tumors.

Treatment.—More or less complete rest of the voice and careful avoidance of exposure to cold and irritating atmospheres are necessary. Smoking and the use of alcoholics and highly-seasoned food are prejudicial. A warm, equable climate is advisable. A moist or dry atmosphere will be suggested by the symptoms. Measures to secure cleanliness of the parts are most important, and are the first to be considered. The atomizer and an alkaline solution are best for this purpose; spraying freely the naso-pharynx and larynx. The various sodium salts, the bi-borate, the bi-carbonate, the salicylate, etc., are used singly or in combination. The usual strength is that of ten grains to the ounce of water. Listerine diluted three or four times with water has been very satisfactory for the same purpose. It possesses more than a cleansing power. As disorders of the alimentary tract and related organs seem

to aggravate catarrhal laryngitis, careful attention should be paid to their function.

Various medicated vapors are advised as especially valuable by Lennox Browne. I have employed only one "heroic" topical treatment, which has proven highly valuable, *i. e.*, a spray of iodine, five grains in from one drachm to an ounce of alcohol. The applications may be repeated daily at first, beginning with the weaker solutions in order to gradually accustom the patient to their use. A properly curved spray tube and a compressed air receiver should be used, as the application should consist of a single puff only, applied while the patient is inspiring. When the changes have been localized, I have applied a saturated solution of iodine in alcohol to the affected spots. If spasm is produced it may be controlled, as Ziemssen recommends, by holding cold water in the throat. The previous use of a strong solution of cocaine will usually prove preventive. Iodine in doses of one drop of the tincture repeated from four to six times daily is at the same time of value.

Locally the various astringents are extensively used. Ziemssen strongly advises nitrate of silver fused upon a probe.

Causticum is to be administered for paresis of the vocal cords, which may remain after the inflammatory symptoms subside. Such patients can often speak naturally when using the ordinary tone of voice, but when attempting to talk in a high pitch the voice fails. *Hepar sulphur* is indicated in cases occurring in persons of a tubercular disposition; secretion is scanty and the expectoration is difficult, and of a tenacious, muco-purulent character. *Kali bichromicum* is often useful in the more active congestives stage with hoarseness and stringy, muco-purulent expectoration. Meyerhoffer also used this drug by inhalation, the solution being one of two grains to the ounce of water. When there is hoarseness, which is worse in the evening, with extreme sensitiveness of the larynx, any effort to talk or cough causes local pain, and if the patient is of the characteristic *phosphorus* type, that medicine may be selected. *Calcarea* is useful in some cases, but its selection must be based entirely on the constitutional peculiarities of the patient.

When *argentum nitricum* is called for there is discharge of muco-purulent sputum, especially from the posterior wall of the larynx. Ulceration may be present.

Manganum is useful in chronic laryngitis occurring in pneumonic or tubercular patients. The hoarseness is worse in the morning, and is lessened by the expectoration of lumps of mucus. There are painful dryness and roughness of the larynx. *Lachesis* has helped cases marked by external and internal hyperæsthesia.

ŒDEMATOUS LARYNGITIS.

Synonyms.—Œdema glottidis; laryngitis submucosa purulenta, etc.

Definition.—An exudation into the sub-mucous connective tissue of the larynx of a serous or sero-purulent fluid.

Etiology.—Œdema of the larynx is usually a secondary affection. Some claim that it is invariably so. Von Hoffman, of Berlin, who bases his opinion on thirty-four cases present in six thousand and sixty-two autopsies, asserts that it is never primary. According to that authority the diseases upon which laryngeal œdema may be grafted are—stated in the order of their importance—cardiac disease, Bright's disease, pulmonary phthisis, and less frequently abscess of the neck, laryngeal ulcerations from traumatism, laryngeal tuberculosis, septicæmia, etc. This affection may supervene upon any inflammatory disease of the larynx or adjacent parts, in connection with the acute infectious fevers, as well as with a variety of constitutional affections. The acute form often follows the swallowing of hot fluids or caustics. Padutcheff reported two cases resulting from the excessive use of ice-water while overheated.

Pathological Anatomy.—The open textural structure of the areolar tissue of the larynx is very favorable to the development of œdema. The character of the contained fluid varies from a quite clear serous fluid to one highly purulent. The upper portion of the larynx is most involved, especially the ary-epiglottidean folds and the base of the epiglottis, leading to prominent swellings at the entrance to the organ. The œdema may be localized. If the swollen parts are punctured, serous or sero-purulent fluid exudes, leaving the tissues wrinkled. Suppuration is always diffuse, focal collections of pus never occurring in rapid cases. The œdema has been known to extend into the trachea and even to the bronchi.

Symptoms.—The progress of œdematous laryngitis is so rapid in many cases that little is complained of before the dyspnœa has developed, and this even then often constitutes the sole symptom. The other prominent phenomena of the disease are dysphagia and aphonia. Usually there are complaints of an obstructive feeling in the larynx with frequent coughing or clearing efforts designed to remove the obstruction, a small amount of frothy, perhaps bloody, mucus being expectorated. The respiratory difficulty is confined to inspiration, which may have a whistling sound. The dyspnœa may exhibit paroxysmal exacerbations amounting to severe asphyxia. Death is not of rare occurrence at such times. Hoarseness is not always marked.

In the absence of a laryngoscope a physical examination may be made with the finger. Unless practised with great caution, however, spasm may be induced by this procedure. Occasionally the swelling is

visible without instrumental aid. With the laryngoscope, the mucous membrane is seen to be of a bright red color, and the swollen epiglottis and ary-epiglottidean folds are prominent features of the image, obscuring the interior of the organ to a greater or less extent. The vocal cords are rarely involved. Gibb first described œdema below the cords, designating it as sub-glottic œdema. It is a chronic variety.

Varieties.—Laryngeal œdema may be acute or chronic, the chronic form occurring in connection with tuberculosis, cancer, syphilis and other deep-seated laryngeal diseases.

Most authors describe four varieties of laryngeal œdema: (1) Typical, originating in the larynx; (2) contiguous, spreading from adjacent tissues; (3) consecutive, secondary to primary disease of the larynx; and (4) secondary. The first form, the "typical," is rarely observed. Morrell Mackenzie states his belief that all the cases of this variety he has seen, have been due to blood-poisoning. The "contiguous" is the most frequent variety, and is usually developed by extension from the pharynx. "Consecutive" œdema supervenes upon perichondritis or other serious structural diseases of the larynx. The secondary form is developed usually in association with an infectious disease, *i. e.*, small-pox, syphilis, scarlet fever, etc.

Diagnosis.—The history of the attack, combined with the laryngoscopic examination, is sufficient to establish the diagnosis.

Prognosis.—The prognosis is unfavorable. Sestier, in his remarkable treatise published in 1852, reports one hundred and fifty-eight deaths occurring in two hundred and thirteen cases. Even if the patient is relieved of the œdema, some form of pulmonary inflammation may develop or death may occur from blood-poisoning or general exhaustion. Secondary œdema of the larynx is highly fatal. Cases in which the larynx is involved from the pharynx are most favorable.

Treatment.—Little can be done in a general way except to place the patient in a comfortable position, feed well with nutritious liquids, and preserve an even temperature and perhaps a moist atmosphere. The depletory measures advocated by many are not in general favor. Ice held in the mouth, or small pieces swallowed, sometimes do good if persisted in. Hot compresses to the neck are thought by some to aid.

Medicinally, *apis* can be recommended as a remedy of decided power over this affection. Recently in a case secondary to scarlatina, in which the tongue was also involved and protruded from the mouth, *apis mellifica* 1x, five drops every one to two hours, unaided by any other measure, exerted a prompt and unmistakable action upon the œdema, the patient making a complete recovery. This is not an isolated experience.

Dr. Thomas Nichol advises *sanguinaria*, which has been used with some success.

The use of *iodine* and its preparations should be thought of on account of their tendency to produce this pathological condition. Sajous and others have observed marked œdema of the larynx from iodide of potassium.

Dr. J. S. Mitchell recommends *arsenicum* as the most important remedy, and claims that prompt action follows its exhibition. The same author advises *lachesis* when suffocative attacks are urgent and the laryngeal mucous membrane is livid. *Tartar emetic* proved effective when the laryngeal œdema was associated with œdema of the lungs.

If relief does not follow the above treatment, free scarification of the tissues must be practised. Pressure is often necessary after the incisions in order to secure sufficient evacuation of fluid. If a suitable laryngeal lancet is not at hand, a curved bistoury wrapped to within one-fourth of an inch of its point with adhesive plaster or muslin may be employed.

LARYNGEAL PERICHONDRITIS.

Inflammation of the laryngeal perichondrium is a rare affection. It may, however, occur as the result of quite a diversity of causes. It may be either primary or secondary. Most prominent among its causes stand tuberculosis, cancer and syphilis, also certain of the acute specific infections, as typhoid fever, smallpox, and diphtheria. Traumatism, even from the frequent passage of the œsophageal bougie, has produced it.

Pathological Anatomy.—Perichondritis occurs most frequently in the cricoid and arytenoid cartilages. Exceptionally it begins on either the outer or inner surface of the thyroid cartilage. The epiglottis is rarely attacked. The membrane is found to contain pus within its meshes, and collections of the same raise it from the cartilage, thus depriving the latter of its pabulum. The natural result is necrosis of the cartilage. The surrounding tissues inflame and suppurate, and the necrotic tissue is thrown off upon the internal laryngeal surface and expectorated. Under these circumstances the expectoration is fœtid.

Symptoms.—The patient usually complains of an aching pain, and the larynx is tender upon pressure. Hoarseness gradually merges into aphonia. Cough is variable. A serious degree of stenosis is often present. When occurring in connection with acute disease, the true nature of the affection is often obscure, as changes in the voice may be the only symptoms directing attention to the larynx. The development of inflammatory changes may be either outward or inward. If the former, the outer surface becomes tender and swollen, and an abscess develops. If the latter, the laryngoscope will reveal localized œdema, corresponding to the region of the diseased cartilage. The œdema may become general. The symptoms vary according to the cartilage affected. When one arytenoid is involved, the cord is directly implicated, and to some degree paralytic. When the cricoid cartilage is diseased, the cords lose their mobility through paralysis of the posterior crico-arytenoids.

Prognosis.—The disease terminates fatally in many instances, and generally from laryngeal stenosis. Even if this feature be controlled for a time, the inhalation of irritant matter may excite pneumonia or pulmonary gangrene. Morrell Mackenzie states that general emphysema may follow perichondritis. Confirmations of this statement have been made by Wilks and Ziemssen, both of whom report cases of this complication. Chronic stenosis from cicatricial contraction is not infrequent in persons who have recovered from the acute inflammatory process. Occasionally the laryngeal condition supervening upon some underlying affection, as phthisis, precipitates a fatal issue.

Diagnosis.—An early diagnosis may be made when there is a localized pain and swelling of some portion of the framework of the larynx without much hyperæmia of the mucous membrane. Later, the involvement of the soft tissues will be found to have increased and the vocal cords to be in some degree, one or both, paralyzed. A fœtid discharge follows. The probe will detect dead cartilage.

Treatment.—In the early stage something may be accomplished by prompt treatment. What was apparently a perichondritis, has been made to disappear under the action of well-selected medicines. *Iodine*, *hepar sulphur*, *mercurius*, *apis*, *arsenicum*, *lachesis* and *silicea* are the remedies from which a selection can be made. *Iodide of potassium* is also a valuable remedy, especially in syphilitic cases, and *aurum muriaticum* should be considered for the same class.

The early use of ice, soothing inhalations, scarification, and leeches are all recommended. Incision of the abscess as early as possible is demanded. In case of a dangerous stenosis, tracheotomy must be performed. After the latter operation, the larynx will require the use of bougies to antagonize the cicatricial contraction.

TUMORS OF THE LARYNX.

Varieties.—Routine use of the laryngoscope shows that tumors of the larynx occur with far greater frequency than was formerly believed to be the case. As in other parts of the body, they may be either benign or malignant. Of the former, papillomata and fibromata are unquestionably the most frequently encountered. Fibro-cellular growths, myxomata, angeiomata, adenomata, enchondromata, lipomata, and cysts, are of exceptional occurrence. Malignant growths are nearly always of the epitheliomatous variety. Sarcomata may invade this region, but are rare.

BENIGN TUMORS OF THE LARYNX.

Etiology.—Benign tumors of the larynx may appear at any age. Papillomata in particular may even occur in children. Fibromata usually attack middle-aged adults. Men seem to be more liable to this

trouble than are women, probably because they are more frequently subjected to the influences which are believed to be determining causes. These are generally acknowledged to be agencies which provoke a chronic hyperæmia of the larynx, as chronic laryngeal catarrh, habitual improper use of the voice, and exposure to an irritating atmosphere. Diathetic causes, as tuberculosis and syphilis, may produce tumors characteristic of these diseases.

Symptomatology.—The fact that benign neoplasms may invade any portion of the larynx makes the resulting symptomatology a most uncertain one. They may be so situated as to produce but little functional disturbance; but in the majority of cases the vocal cords are involved. Some degree of aphonia is apt to be a pretty constant symptom. More or less cough is also to be expected. When the tumor is attached by a long pedicle, its position must necessarily change, and this, besides exciting local irritation, must cause marked variation in the symptoms from time to time. Breathing is not affected unless the growth be sufficiently large to encroach to a considerable degree on the lumen of the larynx. Pain is generally absent. Deglutition is nearly always unimpaired.

Laryngoscopic Appearances.— Papillomata. These growths appear as warty or cauliflower excrescences, attached most frequently to the anterior portion of the vocal cords. They vary greatly in size, in extreme cases reaching that of a walnut, are grayish or pinkish in color; usually attached by a broad base; but may be pedunculated. They may be detached in the act of coughing.

Fibromata. Differing from the tumors just described, fibromata are most frequently pedunculated; but they may be sessile. They are exhibited as smooth lobulated growths, springing most frequently from one of the vocal cords. They are pinkish in color, hard to the touch, and do not bleed readily.

The other varieties of benign laryngeal tumors are so rare, as to need no special description in a work like the present.

Prognosis.—Many cases give rise to but little trouble. The general consensus of opinion among standard authorities is that such should be left alone. Some cases increase rapidly, necessitating prompt surgical interference. Papillomata are exceedingly liable to recur after removal. Operations on fibromata generally effect a radical cure. Some cases, especially of papillomata, disappear spontaneously, or under suitable medication.

Treatment.—This is, for the most part, surgical. Considerable technical skill is required for the removal of intra-laryngeal growths, more, indeed, than the general practitioner can possibly possess. A description of operative methods is therefore inadmissible in this place. The remedies which have given the best results are *causticum, sanguinaria, thuja, belladonna, calcarea phos., conium* and *silicea.*

MALIGNANT TUMORS OF THE LARYNX.

Etiology.—Malignant tumors of the larynx occur most frequently as an extension of similar growths from the pharynx. Still they may appear primarily in the larynx. They are most commonly observed in men of middle age, who, in many instances, seem to have been predisposed by heredity or by exposure to irritating fumes, as of tobacco.

Symptomatology.—The ordinary symptoms of laryngeal disease, viz., cough, dyspnœa and aphonia, are important clinical phenomena, varying in degree in individual cases, according to the situation and size of the tumor. There are also present the ordinary concomitants of malignant disease. Careful examination of the neck frequently discovers the presence of glandular enlargements. Sometimes these are arranged along the course of the recurrent laryngeal nerve, and produce important disturbances in its functions. The bronchial lymphatics are sometimes invaded. Examination of the larynx externally sometimes shows that organ to be enlarged. After the lesion has advanced to the stage of ulceration, the general health fails, and the cancerous cachexia is manifested. Difficulty in swallowing often asserts itself, and pain is more severe and more constant than in any other disease of the larynx. When ulceration takes place, the breath may become very offensive.

Laryngoscopic Appearances.—The site of the tumor is generally surrounded by a high degree of injection and infiltration of tissues. The latter produces more or less impairment of the movements of the laryngeal cartilages. The surface of the tumor itself is irregularly nodular and of a purplish color; when involving the cords, it is of a pale pink hue. The most frequent situation of primary epithelioma is the laryngeal wall. Eventually the tumor undergoes ulceration, giving forth a tenacious offensive discharge. The broken surface is excavated, and is surrounded by ragged edges.

Prognosis.—This is highly unfavorable, the tendency of the disease being rapid progression to a fatal issue.

Treatment.—Extirpation of the larynx has been proposed, and has effected some beneficial results. The remedies called for are those suited to malignant growths generally, namely, *conium*, *aurum*, *hydrastis*, *graphites*, *arsenicum*, *arsenicum iod.* and *acetic acid.*

LARYNGISMUS STRIDULUS.

A short account of this affection appeared in Volume I, in connection with diseases of the nervous system, but its importance demands a more extensive notice than there given it.

Synonyms.—Spasm of the glottis; asthma Millarii; asthma rachiticum.

Definition.—A disease occurring in infants, which in the present

state of knowledge must be regarded as a neurosis, characterized by paroxysms of spasmodic closure of the glottis, manifested by sudden arrest of respiration, upon the cessation of which there occurs a prolonged, high-pitched, crowing, inspiratory sound, and the attack is over.

Etiology.—Laryngismus stridulus is a disease almost essentially of infancy, practically all cases occurring prior to the third year, and the majority of cases during the first twelve months of life. The majority of cases occur in boys. Weather would seem to exert some influence, for most cases are observed during the colder months of the year, *i. e.*, during the winter and early spring. Constitutional causes play a very important part in bringing on the disease, many of the patients possessing well-marked rachitic constitutions. The manner in which rachitis brings about laryngismus stridulus does not seem to have been definitely settled. One authority believes that pressure upon the imperfectly constituted cranial bones is the important cause. Others claim that the paroxysms are dependent upon the nervous irritability of rachitic subjects; and still others that the same general factors which bring about the rachitis, namely faulty nutrition, are responsible for the laryngeal spasms. Escherich teaches that laryngismus stridulus is but a variety of tetany, basing his assertions on clinical observations.

Exciting causes are active in many instances, and consist of the ingestion of indigestible food, diseases of the heart, enlarged liver, nasal and post-nasal disease, dentition, bronchial, tracheal and laryngeal catarrhs, and violent crying.

Symptomatology.—The subject of laryngismus stridulus has no special condition of general health, many subjects giving every outward evidence of depraved nutrition, while others are perfect pictures of health. The paroxysms are ushered in without warning. The child suddenly becomes rigid, throws back its head and gasps for breath. The face becomes cyanotic, and a cold sweat appears upon the forehead. Respiration is thus completely arrested; the muscles of the chest are fixed. There may be associated convulsive movements. Within a very few seconds relaxation takes place, and air enters through the incompletely relaxed glottis with the high-pitched crowing sound already referred to. The number of seizures varies greatly in different cases. Sometimes there may be thirty or forty in the course of the twenty-four hours. They also vary greatly in severity, even in the same case. Again, the paroxysms are repeated at short intervals for a day or so, and then disappear for two or three weeks. Between the attacks there is nothing characteristic of the disease.

Diagnosis.—From local laryngeal disease laryngismus stridulus may be differentiated by the suddenness of onset and short duration of the paroxysms, the freedom from fever, cough and aphonia between the attacks, and their association with slight convulsive phenomena.

Prognosis.—In this country at least the prognosis of laryngismus stridulus is favorable. In Germany and in some other countries where the disease appears to be far more common than it is in America, very heavy mortality statistics are given. It usually runs a slow course. Occasionally the patient has but a few attacks. Very often, however, it persists for two or three months. The subjects of laryngismus stridulus are liable to be seized with intercurrent disease which may end fatally.

Treatment.—As a rule the paroxysm subsides so quickly that the physician has no opportunity to be present. The attendants should therefore receive explicit instructions as to the procedures to be carried out at the time. Mild cases require no intervention. It is different, however, when they are severe or recur at close intervals. Free access of fresh air should be given the patient. The position of the child should be semi-recumbent. Cold water should be dashed with considerable force against the face, or hot moist applications may be applied to the larynx. The position of the tongue must be watched, lest it be curled up back in the pharynx, and still further interfere with respiration. Irritation of the fauces with the finger or a feather by inducing vomiting sometimes relaxes the spasm. Ice applied to the epigastrium, or introduced into the rectum, sometimes induces a prompt return of respiratory movements. When the paroxysms are so prolonged as to produce apparent death, artificial respiration should be instituted.

During the intervals of attacks, the measures adopted have reference solely to improvement of the general health, consisting mainly of plenty of fresh air and easily digested nutritious food, adapted to the age and general condition of the patient.

For the paroxysms themselves, *sambucus, cuprum, chlorine, belladonna* and *ignatia* are the most important remedies. I have usually given *sambucus* the preference unless another medicine is called for by the symptoms. It often exerts a decided influence even in cases which ultimately prove fatal. *Cuprum*, when convulsive phenomena are associated and there is considerable cyanosis; *chlorine*, as recommended by Dunham when expiration is more difficult than inspiration; *belladonna*, in cases exhibiting a marked susceptibility to recurrence of seizures under slight irritation, and *ignatia* when emotional influences seem to be the main cause of attacks. *Gelsemium* in doses of one drop of the tincture given at five minute intervals has been recommended as a palliative on physiological indications.

Between the paroxysms almost any remedy may be indicated, according to the general state of health of the patient.

PSEUDO-MEMBRANOUS LARYNGITIS.

There is still doubt as to the nature of certain cases of pseudo-membranous laryngitis. The active controversy which has been carried on over this subject for many years, has not yet conclusively settled the question. Many of the best observers of the age contend earnestly for the diphtheritic origin of *all* cases of pseudo-membranous laryngitis, while others recognize an idiopathic variety, known generally as "membranous croup." The writer's observations have strongly favored the doctrine of unity. Especially impressive have been cases of primary pseudo-membranous laryngitis, which have been subjected to tracheotomy and have lived long enough to develop their full clinical characteristics. Several such have subsequently manifested the characteristics of diphtheria, dying as diphtheria patients die, and therefore have appeared to be cases of isolated primary laryngeal diphtheria. It seems probable, however, in spite of the doctrine of Strümpell that "the proposition that there are two distinct diseases, croup and diphtheria, is absolutely untenable," that a membranous inflammation of the larynx not due to the action of the germs of diphtheria *may* exist. Inasmuch, however, as many of our most eminent clinicians consider its differentiation difficult or impossible, it is incumbent upon practitioners to regard all cases of laryngitis marked by membranous exudate as infectious, and thereby avoid the risk of communicating the disease to others. The various pathological and clinical differences which have been contended for have not yet been established and it is therefore proper to consider the subject under the one heading

Etiology.—As at least the majority of cases of pseudo-membranous laryngitis are of diphtheritic origin, it is only necessary to refer to what has been already said of the etiology of that disease, and in addition to refer to factors supposed to possess an influence in the production of certain cases, which may not be "diphtheritic." The most prominent of these is cold, and concerning this agent, it can only be stated that, as in the simple catarrhal variety of laryngitis, cold is productive of laryngeal inflammation chiefly on account of peculiarities of nutrition with which we are not perfectly acquainted. Most cases occur in young children, *i. e.*, those under five years of age. Local infections of the naso-pharynx, tonsils, etc., may favor the development of inflammation involving the larynx. The tendency to extension from the pharynx to the larynx is greater the younger the patient. Boys are oftener attacked than girls.

The **Clinical Course** depends much upon whether the laryngeal affection is primary or an extension from the pharynx. If primary, there are many points of similarity to the simple spasmodic or catarrhal laryngitis. There may be several days of warnings in the nature of slight symptoms of cold attended by fretfulness, a slight fever, cough

and hoarseness. The essential symptoms are those produced by stenosis of the larynx. These may develop slowly or rapidly. If the latter, there is in most cases a degree of spasm of the laryngeal muscles, which accounts for the sudden aggravation of the symptoms, and which is apt to occur especially at night. With progress of the disease, the obstruction becomes continuous. One is usually first struck by the marked evidences of dyspnœa. Inspiration is more difficult than expiration. It is slowly performed, and is attended by a sound which is spoken of as sawing, rasping, etc. This is designated "stridulous breathing." This sound possesses diagnostic value, although heard occasionally in other affections. The child usually desires to sit up and calls into use the auxiliary inspiratory muscles. Restlessness and anxiety are proportioned to the degree of difficulty in breathing. With the progress of carbonic acid poisoning, the child becomes cyanotic and quieter, the skin cooler, and gradually falls into a coma which precedes death, unless the obstruction is overcome by surgical means. The degree of obstruction may be best estimated by inspection of the soft portions of the chest. These regions sink inwards during inspiratory efforts because the partially inflated lungs do not follow the expanding chest. Such depressions are best observed in the supra-clavicular fossæ, and along the line of attachment of the diaphragm.

The cough is "croupy." At first it is of a hoarse barking character, but as the laryngeal tissues become thickened by inflammation and the calibre of the larynx is lessened by swelling and pseudo-membranous exudate, it becomes wheezy and suppressed. The less noisy cough and breathing are by the inexperienced often looked upon as indications of relief.

Fever is moderate. The pulse is accelerated, but towards the close it may be either very rapid or slow. There is often an encouraging remission of symptoms during the day, even in cases which terminate fatally. When laryngoscopic examination is possible, the interior of the larynx is found to be more or less completely covered with a grayish exudate, and the vocal cords pale, swollen and paretic. Suffocation has occurred from paresis of the dilator muscles, the posterior crico-arytenoids. This happens if the inspiratory effort is made with too great rapidity, closing the glottis in a valve-like manner. To avoid such a result the child instinctively inspires slowly and guardedly. The gradually increasing difficulty in breathing, caused by the gradually increasing lesion, is complicated by frequent aggravations due to spasm of the laryngeal muscles, and to temporary increase of obstruction from accumulations of mucus and the presence of fragments of displaced membrane.

The **Diagnosis** will depend upon the discovery of pseudo-membrane in association with croupy symptoms. This is accomplished by the laryngoscope, and oftener by the appearance of membrane in the pharynx or in the expectoration.

Prognostic Indications are gathered from its association or not with pharyngeal diphtheria, and the extent of involvement of the bronchi and lungs; and immediately, by the degree of stenosis. J. Solis-Cohen states that the amount of exudate is wholly inadequate to account for the degree of dyspnœa present in certain cases, and suggests the existence of "an element of paralysis affecting the nervous distribution of the ultimate bronchi."

Treatment.—Non-membranous croup is so frequently mistaken for the membranous variety that it is difficult to estimate the true value of much of the experience which has been published relating to the therapeutics of this disease. The general care of the patient should be the same as in the various forms of acute laryngeal inflammation. A rather high temperature and a moist atmosphere are most important. A word of caution upon this point is necessary, however, having observed several children debilitated to a prejudicial extent as the result of too high a temperature; 75° to 78° F. will be a sufficient elevation under any circumstances.

For further particulars respecting the management of these cases the reader is referred to the article on diphtheria. (See p. 211, Vol. I.)

MISCELLANEOUS AND INFREQUENTLY DESCRIBED AFFECTIONS OF THE LARYNX.

I. **Hæmorrhage from the Larynx.**—This is an exceedingly rare accident under any circumstances, and especially so as a primary affection occurring in a previously healthy larynx. The possibility of the latter occurrence has been strenuously denied. Laryngeal hæmorrhage has been observed to occur in singers and others who use the voice to an unusual extent; also as the result of vocal strain. In the majority of cases it is symptomatic of malignant, syphilitic or tubercular disease, and may then be a very serious matter. Idiopathic cases occurring under other conditions are not apt to be of much importance. As to whether or not laryngeal hæmorrhage bears an etiological relationship to phthisis has not been positively decided. Of twenty-two cases reported to the American Laryngological Association three subsequently developed phthisis.

Stepanoff has described a variety of laryngeal hæmorrhage which he has denominated *laryngitis hæmorrhagica*. The symptoms in the beginning differ in no particular from those of the acute catarrhal variety of laryngeal inflammation. Within a period ranging from three to fourteen days, hæmorrhage occurs. The disease affects females only. The quantity of blood lost varies from one-half to four ounces. Catarrhal symptoms remain for some days after the subsidence of the bleeding. The hæmorrhage takes place by diapedesis and from the true vocal cords only.

The treatment of laryngeal hæmorrhage is that of the primary condition. In obstinate cases astringent applications, as ferric alum or the galvano-cautery to the bleeding point, may be necessary.

II. **Rheumatic Affections of the Larynx.**—In the present state of knowledge these must be regarded as of very unusual occurrence. Many well-known authorities claim that cases of rheumatic laryngitis are incorrectly diagnosed œdematous laryngitis, and that the disease is not by any means uncommon. A myalgia of the larynx has been described as occurring under malarious influences. Ingals, of Chicago, has described a chronic rheumatic laryngitis. This affection occurs in persons of a rheumatic diathesis.

Sometimes it accompanies or immediately follows acute inflammatory rheumatism. The principal symptoms are aphonia and some slight pain, which is aggravated in damp weather. The hyoid bone and the posterior portion of the larynx bear the brunt of the disease. Laryngoscopic examination shows swelling of the arytenoid joint. The course of the disease is prolonged and erratic. It is an obstinate affection, although ultimate recovery occurs.

Grünwald in five cases of *rheumatic crico-arytenoid synovitis* seen by him tabulates the symptoms as follows: (1) Disagreeable sensation on one or both sides, referred to the angle of the jaws, especially severe during deglutition. (2) Similar sensation produced by pressure over the region of the crico-arytenoid articulation of the affected side. (3) Sensible, sometimes audible, crepitation upon such pressure and only in response to such pressure. (4) Inward movement of the arytenoid cartilage upon such external pressure. (5) Circumscribed sensitiveness of the region of the joint upon pressure with the œsophageal sound.

Simpson has reported a case of acute rheumatic laryngitis occurring in conjunction with gonorrhœal rheumatism. The local changes in the larynx were such as to permit of no other explanation of the phenomena.

III. **Laryngitis Hiemalis.**—This is a variety of subacute laryngitis described by Mulhall, of St. Louis. From the very beginning, the secretions consist of adhesive crusts mechanically producing dysphonia, more often complete aphonia, and occurring only during the winter when the crusts have been removed (always with complete return of voice) the laryngeal mucous membrane below shows but little inflammatory change. The disease may occur but once, or it may show a most remarkable tendency to recurrence. It is not associated with any other local or constitutional disorder.

The treatment is largely hygienic. Warm clothing, the avoidance of overheated apartments, sleeping in a cold room, cold sponging, silence in the open air, and carefully regulated habits, have been enjoined.

IV. **Laryngeal Neuroses.**—*Chorea* may attack the larynx, and

indeed limit itself to that organ. It is then but a local exhibition of a neurotic tendency. Some cases occur apparently as the result of reflex irritation of nasal hypertrophies, etc. Still others seem to be analagous to writers' cramp and result from the overuse of the voice. The true laryngeal chorea consists of disorderly movements of the muscles of the larynx, these giving rise to peculiar grunting noises. The laryngoscope shows the cords, during rest, to make jerky movements away from the median line. During phonation they act perfectly well. Some cases are associated with peculiar spasmodic cough, not yielding to any treatment. Hoarseness sometimes occurs, but only as the sequence of the violent coughing efforts. All symptoms disappear during sleep.

Laryngeal Nystagmus. H. R. Spencer reported a case of cerebellar tumor in which there were associated nystagmus and rapid rhythmical movements of the laryngeal and pharyngeal muscles perfectly synchronous with those of the eyeball. The pulse was very frequent.

Laryngeal vertigo has been variously interpreted. By some it is looked upon as a variety of epilepsy, but differs from that disease in the readiness with which it yields to treatment directed to the removal of morbid local conditions. It was first described by Charcot. Without previous warning the patient experiences a tickling sensation in the larynx, and this starts violent efforts at coughing. During the paroxysm the patient falls unconscious. He recovers in the course of a few seconds, and is then as well as ever.

V. **Cutaneous Affections** may localize themselves in the larynx. It is believed that some of the laryngeal complications of syphilis are but a simple erythema invading the mucous membrane of this organ. *Herpes* and *pemphigus* have been reported.

Pachydermia verruca laryngis and *keratosis* are rare conditions of technical interest only.

DISEASES OF THE ORGANS OF RESPIRATION.

GENERAL CONSIDERATIONS RELATING TO THE ORGANS OF RESPIRATION.

In the study of no class of affections is it more important to reconsider the gross and minute anatomy and the physiology of the organs involved; for, without a clear notion of the anatomy and physiology of the lungs, their pathology remains imperfectly understood, consequently the symptoms are not explained, and treatment must be less satisfactorily conducted.

Anatomical Considerations.—In the adult male, the average weight of the right lung is from twenty-two to twenty-four ounces, that of the left, a few ounces less. The lungs of women weigh six or seven ounces less than those of men.

The bronchial tubes down to those having a diameter of about 4 mm. divide dichotomously, but beyond this point they continue in straight lines giving off lateral branches which still divide and terminate in tubes of about 0.25 mm.,—the alveolar passages. Cartilages are found in the walls of the trachea and in those of the bronchial tubes. In the former we find from sixteen to twenty cartilaginous rings, which partially surround the tube, leaving the posterior third of the circumference of the trachea occupied by fibrous and nonstriated muscular tissue. The main bronchial tubes, like the trachea, are provided with imperfectly formed cartilaginous rings. In the smaller bronchial tubes, these cartilages are more irregularly placed and fewer in number, assuming the form of oblong plates which completely encircle the tubes. Finally, in very small tubes, those having a diameter of 0.5 mm. or less, they entirely disappear.

The bronchi of smaller calibre contain a few smooth muscle fibres, but elastic fibres, arranged both longitudinally and circularly, replace some of those which have been eliminated. The epithelium in the smaller tubes is gradually flattened and merges into the epithelium of the alveoli. The blood supply to the smallest bronchi is from the bronchial arteries, but their blood is given to the pulmonary capillaries, and unlike that supplied to the larger tubes, enters the pulmonary circulation.

The mucous membrane lining the bronchial tubes contains mucous glands and is covered with ciliated epithelium.

The blood supply to the large and medium-sized tubes is from the bronchial arteries, which are derived from the systemic circulation.

The entire lung is constructed of lobules which measure from 1 to 3 or 4 mm. They are made up of alveolar canals and the distended terminations of the infundibula—the air vesicles. In regard to the tubular portion of this body it may be stated that bronchioles (the smallest bronchi) terminate in alveolar passages which in turn become infundibula (bulbous terminations), and that opening upon the interior of the infundibula are the air vesicles, which measure from 0.25 to 0.16

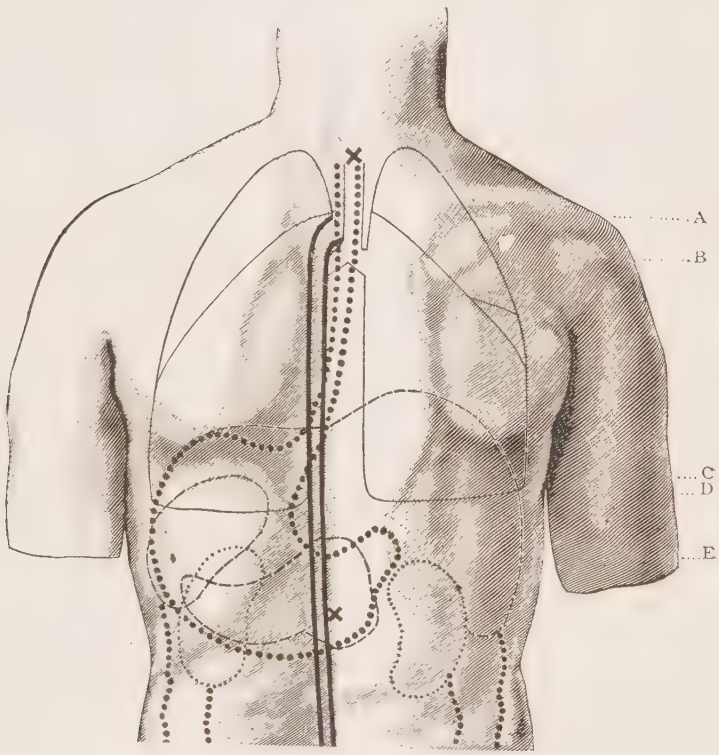


FIG. 20.—(FROM QUAIN'S ANATOMY.)

X. 7th cervical spine = apex of lung.
A. Division between the lobes = tip of spine of 3d vertebra, *i.e.*, 3 inches below summit of lung.
B. Division of bronchi = 4th dorsal spine.
C. Long axis of spleen = 10th rib.
E. Base of right lung = 10th dorsal spine. Base of left lung = 11th spine (base of this lung in diagram represented too high).
D. Upper end of left kidney = 11th dorsal spine, the right being ½ inch lower.
X. = 1st lumbar spine.

mm. The alveolar walls are composed of white connective tissue, rich in elastic fibres, which are grouped especially about the openings into the infundibula, and contain a network of capillaries. The bundles of elastic tissue also contain a few unstriped muscular fibres. The lining epithelium is of a flat and most delicate character, so delicate that its very existence was at one time denied.

The blood supplied to the alveoli comes from the pulmonary artery, but its capillaries are met and fuse with capillaries from the smaller bronchial arteries supplied to the minute bronchi. The blood of the two systems therefore unites.

The gross subdivision of the bronchi are as follows: the branch of the right bronchus which is in most direct continuation of the trachea is given to the lower lobe. The undivided portion of the right bronchus, which is not more than an inch in length, divides into two branches, one going to the upper lobe where it quickly divides into two parts, the other to the middle lobe. Upon the left side the primitive bronchus divides into two branches which are supplied one to each lobe.

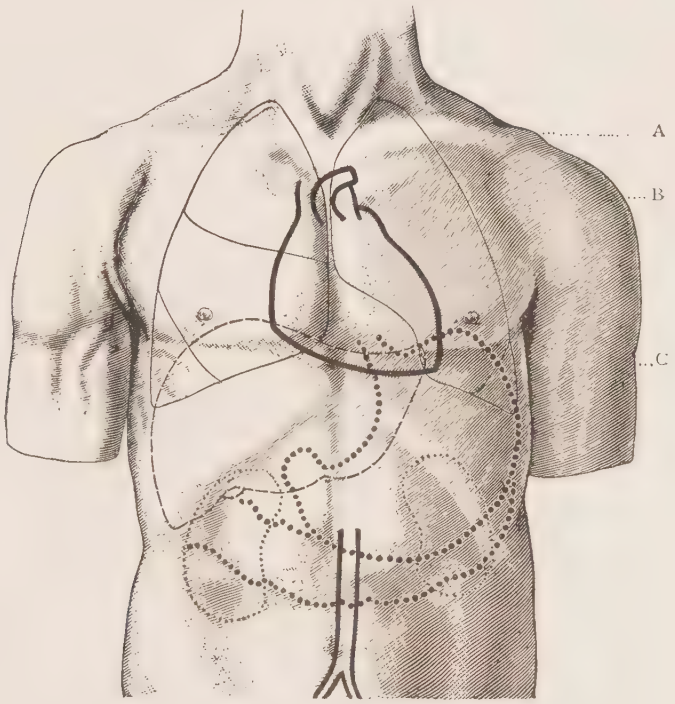


FIG. 21.—(FROM QUAIN'S ANATOMY.)

A. Upper margin of sternum = lower border of 2d dorsal vertebra.
B. 2d costal cartilage = 5th dorsal vertebra.
C. Infra-sternal depression (xiphi-sternal articulation) = lower part of 9th dorsal vertebra.

The elasticity of the lungs is such that upon opening the chest they are found to occupy not more than one-third of the chest cavity. They float on water, have a soft, spongy feeling, crepitate upon pressure, and are of a grayish color in adults.

Each lung is separated by fissures into lobes, the right lung into three and the left into two lobes. Their shape and relation to the chest walls are indicated in the accompanying cuts. The left lung presents a deficiency anteriorly for the reception of the heart, and is somewhat

longer and not as wide as the right lung. The apex of the lung is rounded and extends an inch and a half above the clavicle.

The nerves supplied to the lungs come from the pulmonary plexuses (anterior and posterior). These are formed of branches from the vagi and from the second, third and fourth thoracic ganglia especially. Nerve filaments follow the bronchi, and, according to Remak, form ganglia, which may be single or in groups. Filaments have not been traced to the lobules, although it is safe to presume that such a distribution takes place.

The lymphatic system of the lungs is extensive, involving the alveoli, in the walls of which are stomata communicating with lacunæ, opening into a system of lymph canals about the pulmonary bloodvessels, which in turn anastomose with the lymphatic vessels about the bronchial tubes. The lymphatics distributed to the superficial portions of the lungs enter subpleural vessels. All of these special groups of lymphatics, viz., perivascular, peribronchial and subpleural, communicate with the bronchial glands.

Age brings modifications in the respiratory organs, some of which demand mention. The lobes of the lungs may change their relative position. In the right lung the lower lobe may work backward, forcing the middle lobe forward and downward. In this manner the lower lobe may come to occupy a portion of the normal apex area. The upper left lobe also moves forward, the lower lobe becoming the posterior one. The lung tissue undergoes rarefaction, and consequently diminishes in weight and elasticity. This is much more pronounced at the base, resulting in a great relative increase in the size of the apex, which may be even larger than the base. The greater the shrinkage of the lung tissue the larger the amount of fluid in the pleural sac. Many capillary vessels are destroyed, and the atrophic parenchyma contains carbonaceous particles, often in sufficient amount to impart a dark grayish or blackish color, which is especially true of the lungs of coal miners. The vital-capacity volume gradually diminishes and the respiratory sound becomes feeble and distant, or a marked expiratory murmur of low pitch is added.

Respiration. The respirations in health are conducted noiselessly and with ease, and number eighteen to twenty per minute, but their frequency is much influenced by age. According to M. Roger they average thirty-nine during the first week of life, but may be as low as twenty-five. The frequency diminishes until at six years of age they number twenty-three while awake and eighteen during sleep. A ratio of one to four or five exists between the pulse and respirations. Exceptions to these statements are often noted.

Inspiration is the result of muscular action, although some physiologists antagonize this view, contending that in quiet breathing the

elasticity of the chest walls favors inspiration. It is usually automatic, but susceptible of reflex influence as well as under the control of the will. In men it is effected by the action of the diaphragm with the assistance of the lower intercostals. In women the upper intercostal muscles are actively interested. In infants the diaphragm is assisted by other muscles in but a trifling degree. These statements explain the meaning of the several terms which are applied to different types of breathing, viz., superior costal, inferior costal, and abdominal. Under the operation of all the respiratory muscles the size of the chest is increased in all directions.

Expiration is about one-third shorter and follows immediately upon inspiration. It is the result of recoil of the elastic structures entering into the composition of the lungs and chest walls. Muscular action is developed, however, if an obstruction to expiration exists.

The lungs and chest walls move in unison, but movement is less conspicuous in the upper third of the chest. The lungs do not expand equally in all directions, but from behind, forward and downward, consequently the areas which undergo the least motion are at the apex and upon the upper posterior portions. Collapse of the lung in any considerable degree is followed by retraction of the adjacent chest wall. Entrance of air into the pleural cavity is followed by collapse of the lung.

Introduction of oxygen into the blood and the removal of effete matters, the most important being carbonic acid gas, are the most important of the objects of respiration. In ordinary breathing the expired air contains about 5 per cent. less oxygen than that which is inspired and nearly the same amount of carbonic acid gas is found in the expired air. The normal rate and depth of the respirations furnish the proper amount of oxygen and remove a sufficient amount of carbon dioxide to secure a proper performance of function. If, as under certain circumstances, there is a diminution in the depth of the respirations the loss is compensated by an increase in frequency; *per contra*, what is gained in depth is lost in frequency. The regulation of respiration is accomplished by the nervous system through the respiratory centre in the medulla, which is stimulated by the blood and also by afferent impulses conveyed by the vagus. There is experimental evidence in support of the theory that it is the venous quality of blood which acts as a stimulus to the medullary centre, and further, that the reduction in the amount of oxygen it contains is a more influential factor than an increased amount of carbonic acid. The impulses sent out by the respiratory centre are expiratory as well as inspiratory. An excess of oxygen in the blood (apnœa) is characterized by a prolonged interval between the acts of respiration. The respirations are rendered rapid and superficial by stimulation of the pneumogastric nerve, and may be ultimately

arrested in inspiration; while stimulation of the superior and inferior laryngeal nerves, of the nasal section of the fifth nerve, and of the cutaneous nerves, especially those distributed to the upper portion of the trunk, results in a slowing and deepening of the respirations with arrest in expiration. Referring only to expiration it may be stated that this result is not invariable, which has been attributed to the fact that varying degrees of stimulation may produce opposite effects. Aside from the influence of oxygen, carbon dioxide, etc., upon the respiratory centre, it may be excited to increase function by strychnine, atropine, ammonia, brucine, duboisine, apomorphine, theabaine, digitalis and heat. It is depressed by chloroform, ether, chloral, opium, alcohol, gelsemium, aconite, veratrum, physostigmine, muscarine, and cold. Certain drugs, such as nicotine, caffeine and colchicine, first excite and then depress.

Respiration is diminished in frequency in collapsic conditions, when respiration is obstructed, and in certain affections of the nerve centres. It is usually increased in inflammatory and febrile affections. The greatest rapidity known occurs in hysteria. Prolonged sighing-breathing occurs in some cardiac and gastro-enteric conditions, while expiration is increased in asthma, emphysema, etc. In some serious forms of disease the respirations rapidly increase in rapidity and depth to an acme, then as rapidly decrease in frequency, becoming correspondingly shallow, until a state of apnœa is present. This is known as the Cheyne-Stokes respiration.

The word dyspnœa indicates difficult respiration, regardless of its rapidity. The evidences of exertion are manifested in the nares, which dilate during inspiration, or the mouth may be opened with each breath, or the muscles of the neck become prominent, or in aggravated dyspnœa, such as attends asthma, emphysema, etc., all of the muscles of respiration are called in play, the patient laboring in agony. Sounds may attend both inspiration and expiration when obstruction of the larynx exists, such breathing being called stridulous and typically developed in spasm of the glottis. Wheezy and musical sounds may attend bronchitis, asthma and emphysema.

PHYSICAL EXAMINATION OF THE RESPIRATORY APPARATUS.

Attention can be called only to some of the most important features of the several methods of physical examination of the lungs. In all instances examination should be methodical, and carried out in the following order: (1) Inspection; (2) palpation; (3) percussion; (4) auscultation.

Inspection.—Place the patient in a good light, with the chest bared, and view its surface from different positions. Evidence of impaired motion or depression of the chest wall may often be readily discovered

by standing behind the sitting patient and looking downward over the anterior surface of the chest. It may first be noted that the skin indicates anæmia, is yellow from jaundice, pigmented from Addison's disease or the effect of blisters, or a skin eruption of some form may be present. The marks of herpes zoster are often visible for a long time. Scars due to cupping, leeching and thoracentesis are often met, and suggest search for the remains of previous disease. The state of the superficial veins should be noted, as in obstruction of an intra-thoracic character they may be distended, or subcutaneous œdema or emphysema may be present. The state of the chest walls as to their amount of fat and muscle, as well as the degree of rigidity of the cartilages, should be noted.

Abnormalities in contour and size may be present, *e. g.*, unilateral enlargement of the chest, resulting from effusion into the pleural sac, and causing a distention at the base of the chest; or by air (pneumothorax). Less frequently, hypertrophy of the heart, or effusion into the pericardium, is attended by prominence of the cardiac region. Still less often, aneurism or neoplasms involving the sternum, ribs, lungs, spleen or liver, may cause localized protrusion. Dilatation of both sides of the chest may be the result of emphysema, which enlarges the chest in all directions, or of double pleural effusion. Retraction of a portion or all of one side of the chest occurs most frequently as a result of chronic pleurisy or of chronic fibroid phthisis. In the latter affection the change is generally most conspicuous in the upper and anterior portion of the chest. Several abnormalities in shape have received special names. The "rachitic chest" has two shallow grooves extending longitudinally, one on each side, at the line of union of the cartilages and ribs. The "pigeon-breast" is marked by lessened lateral diameter and a prominence of the sternum, due to a straightening of the ribs anterior to their angles. Transverse depressions may be observed and are attributed to affections preventing the free access of air to the lower portion of the lungs, notably bronchitis. All these deformities are developed in the young, while the chest walls are flexible. The "pterygoid chest" is characterized by narrowness and lack of antero-posterior diameter. The scapulæ project like wings, and the ribs are unusually oblique. A modification of this form is the "flat chest," in which the true ribs are abnormally straight. The appearance of the chest anteriorly is flat, and the sternum may be depressed below the costal cartilages.

Careful observation of the breathing affords valuable information relating to the nature of the disease present, *e. g.*, if one side is motionless, especially about the lower portion, it suggests fluid or air within the pleural sac or a lobar pneumonia. General immobility suggests extensive pleural effusion or pneumothorax. Depression of a portion of the chest wall, which is especially conspicuous during inspiration and with promi-

nence during expiration, is observed in pulmonary phthisis over the site of a cavity, which is usually in the upper portion of the lung; also over an adherent pericardium, and at the lower portion of the chest and in the epigastrium in a variety of affections attended by laryngeal obstruction.

In middle or advanced life the chest walls often manifest some degree of rigidity due to senile changes in the costal cartilages and in the ribs, but as it is a condition which not uncommonly complicates disease even in young subjects, its possible existence in such persons should be considered and its evidences searched for. It may develop to absolute fixation of the parietes. Impaired respiratory movement is the most important sign of this condition. The injurious influences are manifested mainly in increased gravity of intra-thoracic disease.

Palpation.—Touch is employed very largely to confirm the result of inspection. It is of especial value to test the vibrations produced by the voice (vocal fremitus), which are communicated through the air contained within the air passages, and by it to the chest walls. Normally this is more marked in men on account of the lower pitch of the voice, and it is normally more pronounced upon the right side on account of the larger calibre of the right bronchus and the less acute angle at which it is given off. It is less distinct in fat persons or those having very muscular chest walls, and is increased in persons having thin, elastic parietes, or who are emaciated. An increase of vocal fremitis attends consolidation of the lung regardless of its nature, and is diminished by accumulations of fluid or air in the pleural cavities, the degree of diminution depending upon the amount of the accumulation. Obstruction of a bronchus also partially removes fremitus. The attrition of two roughened surfaces, as in pleurisy, and vibrations of the bronchi and contained secretion (bronchial fremitus), may be appreciable to the hand (friction fremitus). Vibrations of fluid in superficial cavities of the lungs (cavernous fremitus) are also sometimes appreciable. When large quantities of fluid distend the chest, fluctuation may be secured by pressing the palm of one hand firmly upon its surface and percussing an intercostal space at a little distance from it.

Percussion.—This method of examining the chest is performed by striking its walls with the finger tips or plessor (immediate percussion),



FIG. 22.—PLESSOR.

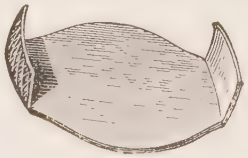


FIG. 23.—PLEXIMITER.

or more often, by the intervention of a plate of hard rubber or ivory (mediate percussion). The mediate object is called a pleximiter. Per-

cussion is satisfactorily accomplished by employing the middle finger of the left hand as a pleximiter, and one to three of the finger tips of the right hand as a plexor. If the fingers are used, motion should be from the wrist only. In percussion we study the sounds produced with reference to intensity, pitch and tone, all of which are qualities of a musical sound. Intensity is the least important of these, as it depends mainly upon the force employed. Modifications of tone are characterized as clear, dull, muffled or obscured, the words being in themselves sufficiently explanatory. When decidedly dull, all musical quality has disappeared; it is, therefore, simply a noise of variable degree of intensity, and without pitch. Variations in pitch are dependent upon the rapidity of the vibrations which are excited. These are greatest over bone, less over the region of the large bronchi or trachea. Over the lung the note is spoken of as normal percussion by some, by others as subtympanitic in comparison with the tympanitic sound, which is developed over the abdomen or cavities of size containing air. If the fingers are employed for percussion purposes, a greater or less sense of yielding will be appreciated. This is termed percussion resistance, and is a most important factor in diagnosis.

Percussion of the Normal Chest. The left chest anteriorly is normally resonant, except over the triangular space occupied by the heart, which is limited above by a line crossing the sternum at the junction of the fourth ribs. The left boundary is represented by a line drawn from the point of union of the fourth left costal cartilage with the sternum to the apex beat, and the right border, by the left edge of the sternum. The lower line of dulness is indicated by a line extending from the apex beat to the sternum, drawn at a right angle to the latter. The inferior line of dulness cannot be accurately determined, as it blends with that due to the liver. Over the right chest the percussion note is normal down to the sixth rib, where liver dulness is met. The resonance is relatively less over the apex of the right lung and in the fifth intercostal space. The sternal region is resonant. In the axillary line upon the left side resonance is normal down to the ninth rib, and upon the right side, to the eighth rib. Posteriorly the resonance is not as perfect as over the anterior surface of the chest, and reaches to the tenth rib upon both sides.

Percussion in Disease. Diminished resonance attends upon any disease of the lungs characterized by consolidation of tissue; it consequently attends pneumonia, phthisis, pulmonary infarcts, neoplasms, collapse, etc. Lung cavities surrounded by fibrous unyielding walls, especially if filled with fluid, collections of fluid in the pleural cavities or in the pericardium, also lead to dulness, and with large accumulations of fluid there is flatness on percussion. Occasionally the percussion sound possesses a special character, one of the most important being the

bruit de pot félé of the French (cracked-pot-sound). It is produced by the sudden expulsion of air from a cavity, and may be developed by percussion over a cavity communicating with a bronchus while the mouth is open, or at the edge of a consolidated area, as in pneumonia, or at the surface of a pleural effusion. It also attends pneumothorax associated with an external opening.

When cavities are of considerable size, have a smooth interior and arched walls, percussion yields a sound possessing a metallic quality, and which is designated amphoric. It is comparable with the note produced by percussing a bottle. It may also attend pneumothorax.

Auscultation.—The origin of the sounds attending breathing, whether these sounds are normal or modified by disease, has been the subject of considerable discussion, but it appears to be demonstrated that with the exception of the vesicular sound attending the inspiratory effort all originate within the larynx, but undergo modification in transit through the structure of the lung and chest wall to the ear. According to Skoda and most recent observers, the vesicular murmur is composed of sounds produced by the entrance and exit of air through the glottis and which are conducted downward through the bronchial tubes, *plus* innumerable *bruits* developed in the pulmonary lobules. All non-vesicular respiratory sounds are developed in the glottis and modified by the character of the medium through which they are transmitted.

Auscultation is performed by direct application of the ear (immediate auscultation), or through the medium of the stethoscope (mediate auscultation). Mediate auscultation is generally employed. It permits the most exact examination of small areas, and is often preferable upon grounds of delicacy as well as cleanliness. There are many examiners, however, who prefer the immediate method for ordinary examination of the lungs, while others consider it much superior, upon the ground that delicate but important sounds are eliminated in their passage through the stethoscope. Whether the ordinary hollow wood, vulcanite or metal stethoscope, for use with one ear, or the more complicated binaural instrument shall be employed, is a matter largely of personal taste, although a good double stethoscope after sufficient experience possesses undoubted advantages. The author has had in constant use for a dozen years one of Paul's binaural stethoscopes, which is as valuable for all purposes as any form in use, and much superior in some respects to any other variety.

Auscultation of the chest enables us to hear the sounds incident to the entrance and exit of the breath—breath-sounds—also the voice-sounds, and finally those dependent upon changes in the pleura.

Breath-sounds. Heard over the lungs, the sound attendant upon inspiration is of a faint rustling kind, often spoken of as breezy, and is continued over the first portion of the expiratory effort. The intensity

of this sound is greater if the respirations are increased in frequency and depth. The expiratory portion of this sound is frequently inaudible. The respiratory sound, as developed in the lung parenchyma, is designated the vesicular murmur, and when abnormally loud, as it may be in one lung when the other is consolidated, it is called "puerile," "exaggerated" or "compensatory respiration." In the normal chest the vesicular murmur is present over the entire chest anteriorly, laterally and posteriorly, excepting a portion of the interscapular space behind, and the upper portion of the sternum in front. It is rather more distinctly heard upon the right side of the chest, and is better developed over the anterior than the posterior surface. It is least distinct over the scapulæ, as it is best developed in the infraclavicular spaces.

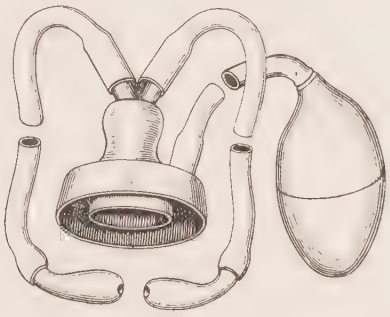


FIG. 24.—PAUL'S BINAURAL STETHOSCOPE.

As heard over the larynx, trachea or large bronchi, the respiratory sound is of a harsh blowing character, and attends both the inspiratory and expiratory efforts, which are nearly equal in duration. These sounds may be readily distinguished between the scapulæ from about the seventh cervical to the fifth or sixth dorsal vertebra, but are impaired if the chest-walls are too thick. As developed in both the parenchyma of the lungs and the large tubes, the respiratory sounds should be carefully studied upon the normal subject, which is vastly more instructive than knowledge gained from books.

When the quality of harshness is added to the vesicular murmur it is characterized as "harsh," "exaggerated," "*broncho-vesicular*" or "vesiculo-tubular breathing." This condition is one of diminution in some degree of the vesicular sound, and its replacement by sounds conducted from the glottis. The special features of harsh breathing are prolongation and elevation in pitch of the expiratory murmur, and the separation by a distinct interval of the inspiratory and expiratory sounds. It is not uncommon for elevation of pitch and increased intensity to attend the inspiratory sound only, expiration being absent. Inspiration is nearly always regularly evolved, but occasionally is interrupted or jerky in character, and frequently called "wavy respiration." The

expiration is seldom implicated, and varies in character. Wavy breathing possesses little significance, being frequently met in nervous persons, as the result of a want of regularity in the action of the muscles of respiration, *e. g.*, when chest pains exist. It may have a cardiac rhythm being excited by the heart's pulsations, or is attendant upon lesions of the lung parenchyma which induce a want of uniformity in the elasticity of the lung structure. A form of interrupted breathing, allied to the foregoing and due to obstruction in the finer bronchi, has been called "cogged-wheel" respiration. The obstruction is usually due to secretion of such consistency that it does not bubble. It is not uncommon for this sign to be replaced later by râles.

Bronchial or *tubular* breathing is heard over consolidated areas of lung, and resembles closely the sounds heard upon auscultation of the trachea. There appears no reason to doubt that tubular breathing is the glottic sounds which are conducted in nearly full intensity through the morbid area to the ear. Lungs which have collapsed from any cause, are compressed by pleuritic effusion, and contain dilated bronchi, or phthisical cavities with dense walls, may also give rise to this character of respiration. A study of the inspiration and expiration reveals an interval distinctly separating them. They possess about the same duration, cease abruptly, and are generally of higher pitch than the tracheal sounds.

The locations of bronchial breathing in the normal chest should be carefully noted.

Cavernous breathing is a modification of the breath sounds resulting from the formation of a cavity in the lung which communicates with one or more bronchial tubes. Both inspiration and expiration are of a hollow blowing character. The sounds are slowly evolved, and the peculiarities more pronounced in expiration, which is lower pitched than inspiration. Cavernous breathing requires for its production a cavity of considerable size which is empty or only partially filled with fluid. Some observers think the walls of the cavity must be sufficiently flaccid to permit of expansion and collapse during the breathing efforts, but I am certain this is not essential. Destructive diseases of the lung, *e. g.*, phthisis, abscess, or gangrene, are the most important causes of cavities.

Amphoric breathing is a modification of the cavernous variety. The change is one of increased intensity, the hollow blowing sound of cavernous breathing being exaggerated and resembling the sound produced by blowing into a bottle. The sound is musical, rather metallic in quality and heard during one or both respiratory efforts, but more especially during expiration. Amphoric breathing is heard over large superficial cavities, and also over the pleural sac when there is a free opening into the lung. It may, therefore, be a sign of pneumothorax or pneumohydrothorax. The peculiar qualities imparted to respiration by cavities, are subject to modification or elimination according to the amount of con-

tained fluid and the condition of the walls of the cavity. They may be quickly altered in some instances by coughing, especially if attended by free expectoration, or by change of position.

When the qualities of the respiratory sounds are not bronchial enough to be called tubular, nor sufficiently cavernous to make use of that term, the compound "*broncho-cavernous*" is applied by some. It is developed in pulmonary cavities surrounded by a considerable thickness of consolidated lung tissue.

Adventitious Sounds (râles). A variety of dry and moist sounds often accompany the respiration. They are developed within the bronchi, air vesicles, or within cavities opening into the bronchial tubes.

Dry râles, or *rhonchi*, are musical notes which are the result of vibrations excited by a diminished calibre of the bronchi, from a variety of causes. They may be of low pitch (sonorous), or of high pitch (sibilant). The former are relatively coarse, the latter, fine. The coarse sounds are developed in the larger tubes, the fine ones in the small bronchi. Dry râles are due to various conditions interfering with the free passage of air, especially bronchial catarrh with swelling and thick secretion, also bronchial spasm. Sonorous râles are developed in bronchi above one-sixth or one-eighth of an inch in diameter, and are present in rather larger numbers during inspiration. They vary much in quality, and appear and disappear even beneath the examiner's ear. If removed by coughing efforts, they are due to bronchial secretion; when due to spasm they may be controlled temporarily by inhalations of chloroform, or by nitro-glycerin. Rhonchi are most frequently met in acute bronchitis and asthma, and less frequently in the bronchitis of phthisis and of pneumonia, but, in these latter affections, are usually associated with moist râles. The respiratory sounds are much obscured by the presence of rhonchi.

Sibilant râles are developed in the small bronchi, and are due to the same pathological conditions causing the larger variety. They vary much in quality, and are heard in greatest number during inspiration. When present in great quantity they strongly suggest asthma or capillary bronchitis. They are heard in small numbers in some cases of simple bronchitis, and not infrequently in phthisis, in which disease they are localized, corresponding to a localized bronchitis excited by tubercular disease.

Sibilant râles are seldom removed by coughing efforts, but are often altered thereby.

The *crepitant râle* is the finest of all râles and is rated by many as possessing also the quality of dryness. Some recent observers ascribe it to pleural friction, but the older idea of its dependence upon the separation of alveolar walls which are lined with a viscid secretion appears to more nearly explain this râle in all its clinical relations. The theory that it

is due to air bubbling through liquid in the air vesicles and fine lobular passages, is not supported by positive evidence, and the character of the secretion in pneumonia, in which it appears in its typical form, is opposed to the idea. This râle is closely simulated by the sound produced by throwing salt upon the fire or by rolling the hair between the thumb and finger near to the ear. Crepitant râles are heard only during the latter portion of the inspiratory effort, give the idea of great numbers, and are usually confined to a single lobe. They are highly characteristic of the early stage of lobar pneumonia, but are found in small numbers in hyperæmia of the lung, in pulmonary œdema, and within small areas of phthisical consolidation. This râle is but slightly affected by coughing, especially when associated with pneumonia.

A variety of sonorous rhonchus often due to pressure upon a bronchial tube by an aneurismal tumor or new growth of some form, or to paralysis of the vocal cords, is known as *stridor*. It is heard over the affected side and consists of coarse vibrations of low pitch which may be appreciable to the hand—*rhonchial fremitus.*

Moist sounds. Mucous râles (crepitations) are the result of the passage of the air through fluids contained in the bronchi, large and small. Some think they may be produced in the alveoli also. The fluid may be mucus, pus, serum, or blood. The several varieties are based upon the size of the air bubbles, the larger bubbles developing in the large tubes and the smaller ones in the fine bronchi. A large râle developed within a cavity is called a *gurgling râle.* In the larger tubes the râles have a moist bubbling character and are heard during both inspiration and expiration. If loud, they may be heard at a distance from the chest. Their pitch depends upon the condition of the surrounding lung tissue, being of high pitch when developed in consolidated tissue, low pitched if the lung structure is normal. This is the râle of simple bronchitis. It is present in its most typical form in the chronic variety of this disease and appears in acute bronchitis with the disappearance of the dry stage. It may be due to blood and therefore associated with hæmorrhage, or to the presence of serum, and a sign of pulmonary œdema.

Subcrepitant râle. A variety of the moist râle is known as the subcrepitant on account of its similarity to the crepitant. It is produced in the finest bronchi, and, according to some observers, in the alveoli also. They are developed by the passage of air through secretion, the pitch being determined, as in the case of the larger râle, by the condition of the surrounding lung structure. Marked consolidation accentuates them sharply. They are heard in greater numbers during inspiration, although not limited to this effort. Subcrepitant râles develop in capillary bronchitis, pulmonary œdema, in the third stage of lobar pneumonia, and in hyperæmia of the lung. They may be limited to hæmorrhagic or phthisical areas, and are often found in brown induration of

the lungs. It is one of the most important evidences of phthisis, which disease is a frequent exciting cause of localized capillary bronchitis.

Dry crackle or mucous click is a fine, dry, well-defined râle heard during inspiration and represented by from one to three clicks. It is due to the sudden separation of swollen, sticky, bronchial surfaces. It is strongly indicative of pulmonary phthisis, being often heard below the clavicles in the early stage of this disease. It is also heard in a variety of chronic conditions of the lungs. The accompanying breath-sounds are broncho-vesicular.

Moist crackle is also described. It is heard during the close of inspiration and even in the beginning of expiration. This râle is variable in size and moistness, and attends the softening of phthisical nodules. With the progress of destructive changes this râle becomes gurgling, or later, cavernous in character. As lesions of other kinds may be developed about the primary phthisical focus a variety of râles may accompany moist crackling.

If while auscultating a cavity containing air, a coin held in contact with the chest wall is struck by another coin, a metallic ring is produced which has been called the "*bell sound.*" A less clear metallic sound—the "*anvil sound*"—is often developed under similar conditions. These signs are particularly well developed in pneumothorax.

Adventitious Sounds Emanating from the Pleura. Of these the pleural friction sound is most important. In health pleural surfaces glide freely over each other without resulting sounds, but if from inflammation these dense, polished membranes are roughened, the respiratory efforts are attended by a friction sound or "rub," as it is often called. This sound has been aptly described by Fagge, who says "it is difficult to describe in words the characters of the pleuritic rub; one must hear it to appreciate it. But I may say that in its most typical form it consists of an irregular succession of short, harsh sounds, which give one exactly the impression of something catching or dragging against an obstruction and then slipping, but only to catch or drag once more." In its typical form it can be readily recognized by the following characteristics: It is heard during inspiration, less frequently during expiration, or during both acts. Its relationship to the breath-sounds is not, however, nearly as fixed as is generally believed, being sometimes heard only at the close of deep inspiration, or succeeding the close of the expiratory act, in so far as the movement of the chest walls is appreciable. The sound varies from a slight rub to a rough grating, which may be perceptible to the patient as well as to the hand of the examiner, and may be of a creaking kind. When very fine it sometimes simulates bronchial râles of various sorts, especially crepitant or small mucous râles, but differs in being unaffected by coughing efforts, as are moist râles. The superficial character of the sound is usually marked, and it may often be altered in intensity and even

in character, by pressure of the stethoscope or ear. The area over which it is heard may not be greater than a square inch, or it may be audible over the entire side of the chest. Its unilateral development is an important factor in diagnosis. The regions over which the friction sound is most apt to be heard are the lower portion of the chest, laterally or posteriorly, but every portion should be carefully examined.

A variety of sounds which are but rarely heard are described as *crumpling*, *crackling*, *creaking*, etc. They are due especially to chronic pleuritic adhesions, the distention of emphysematous lung tissue, syphilitic disease of the lung, and phthisis.

Metallic tinkling is represented by occasional high-pitched, silvery, tinkling sounds, varying in number from one to several, which attend inspiration or expiration. It is more apt to be excited by forced breathing, also by coughing or deglutition. This sound is caused apparently by the falling of drops upon a fluid surface, and is therefore found associated with large cavities containing fluid, and more frequently with pneumo-hydrothorax when the cavity of the pleura communicates with the bronchial tubes.

Succussion.—A splashing sound may be developed in a cavity containing both fluid and air by shaking the patient sharply. It is readily heard with the ear over the cavity. This sign attends hydro- and pyo-pneumothorax most frequently, less often it may be developed in large cavities of the lungs. The sound resembles that produced by shaking a bottle or vessel containing a fluid of some sort. A *succussion fremitus* may be appreciable to the hand.

Less frequently employed aids to the diagnosis of chest affections are spirometry, stethometry, pneumatometry.

Spirometry is the method of measuring the amount of air exhaled after the lungs have been inflated to their fullest extent, which represents the "vital capacity" of the individual. The spirometer is constructed upon the same principle as the gasometer, viz., one cylinder suspended by cords and weights within a second cylinder filled with water. A scale is arranged at the side, indicating the number of cubic inches of air forced into the cylinder through rubber tubing. This method is but little used. Spirometers not larger than a watch are now procurable.

Stethometry, which is the graphical recording of the chest movements, is accomplished with an instrument called a stethometer, and by some the pneumograph. A simple form of the instrument consists of an elliptical india-rubber bag about three inches long, to one extremity of which is attached an india-rubber tube. This bag is fastened to any portion of the chest desired by means of a strap and buckle. The movements of air within the bag are communicated to a tambour, the writing lever of which records the movements upon a revolving drum. By

using one upon each side of the chest the movements of the two sides may be contrasted. This method will be little used; for while well-defined diseases, such as emphysema, give characteristic tracings, the results of investigations of less pronounced lesions have yielded little of value.

Pneumatometry.—A comparison of the power exercised during normal and forced breathing has been carefully estimated; a variety of instruments has been employed.

The one used by Waldenburg, who has investigated this method with care, consists of a manometer with a mask covering accurately the nose and mouth. Each of the limbs of the manometer is about twelve inches in length and filled to the centre with mercury. In ordinary breathing the mercurial surface varies from one to two millimetres, and with forced inspiratory efforts the mercury is held at a *minus* pressure of two and one-half inches, this being about doubled for a momentary period. The power of the expiratory effort was shown to be twenty to thirty millimetres greater than the inspiratory effort, forced expiration developing a positive mercurial pressure of about three and one-half inches, and this could be doubled by force for an instant. Variations from the normal standard are frequently observed, *e. g.*, diminution of the inspiratory power with normal expiration is observed, especially in obstructive disease of the air passages in phthisis, in which disease it may be determined, even in the early stage and less frequently in pneumonia and pleural effusions.

In emphysema, asthma and bronchitis, and in various affections below the diaphragm which impair the action of the muscles of expiration, the expiratory force is diminished while the inspiratory power is normal, or increased. If it should be subnormal, the inspiratory effort is still relatively greater than that of expiration.

Study of the Vocal Sounds.—It is necessary to first study the normal vocal resonance of the chest in order to establish a standard for comparison. Upon auscultation, during phonation, the unemployed ear being closed to exclude sounds emanating from the mouth, with the exception of the regions where bronchial resonance is normally found, only a muffled, indistinct sound is heard, the articulated words not being recognizable. The intensity of the sound varies with the thickness of the chest walls and the character of the voice, an intense low-pitched voice producing stronger vibrations. The normal resonance over the lung parenchyma is designated vesicular or normal vocal resonance; over the large bronchi it is termed bronchial resonance; over the trachea, tracheal resonance; and over the larynx, laryngeal resonance. A notable exception occurs at the right apex (Flint), at which point there is an approach to bronchophony, in a few normal chests. An increase of vocal resonance is known as *bronchophony*. This condition is then simply one of increased intensity, and develops under conditions practically identical with those

giving rise to bronchial breathing, *e. g.*, pulmonary consolidations of all sorts, collapse of the lung, compression of the lung by fluid exudate, bronchophony being present over the compressed tissue, which is usually in part above the fluid. It is also heard over lung cavities with dense walls.

When bronchophony is exaggerated, the spoken words being heard with considerable distinctness, it is called *pectoriloquy*. This sign may be diffused over a considerable area of lung consolidation, or be limited to a small space. In the latter case it corresponds to the site of a cavity, the walls of which are smooth, and which communicates freely with a bronchial tube. When associated with a cavity the sound may have an amphoric quality.

A second variety of bronchophony is called *ægophony*. It has been compared with the bleating of a goat. The sound is tremulous and appears remote, *i. e.*, as if coming from a distance. It attends consolidated lung structure which is removed from the chest wall by a thin stratum of pleural effusion, and is then diagnostic of moderate pleural effusion, also of pleuro-pneumonia. It is rarely observed in phthisis or in pneumonia.

Occurring under the same conditions as amphoric respiration and amphoric resonance, we find the *amphoric voice* which has a hollow musical character. The words are not distinguishable, but are succeeded by a musical element which has been called the *amphoric echo*. This sign is especially significant of pneumo-hydrothorax.

To Flint we are indebted for a careful study of the *whispered voice*. As a method of testing vocal resonance, it is highly esteemed by physical examiners, many considering it superior to the loud voice. The normal whisper gives sounds of a tubular quality over the upper portion of the chest, which should be carefully studied in persons having, without doubt, normal lungs. Departures from the healthy standard are caused by consolidation and the formation of lung cavities. An "exaggerated whisper" attends slight consolidations, becoming "whispering bronchophony" with more complete solidification. Over pulmonary cavities the "cavernous whisper" and "whispering pectoriloquy" are heard, and when the pleural sac contains air, the "amphoric whisper."

DYSPNŒA.

Dyspnœa is a symptom of sufficient importance to demand special consideration. Difficult breathing as observed in different cases presents peculiarities which have led to its classification into several varieties.

The simplest form is that in which the respiratory acts are increased in frequency and force (simple dyspnœa), and is developed in its typical form after violent exercise, such as running. When highly developed, the alæ nasi dilate vigorously, speech is difficult, the chest heaves, and the countenance is anxious. Simple dyspnœa attends many conditions, notably inflammatory disease of the lungs, various affections of the

nervous system, diseases of the heart, accumulations in the pleural and abdominal cavities interfering with the expansion of the lungs, etc.

A milder degree of difficulty in breathing is ordinarily designated "short breath," which condition is one of consciousness of a degree of labor attending the respiratory acts. It is observed in debility, affections characterized by anæmia, and chronic lung or heart diseases. The respiratory acts are usually but not necessarily accelerated, and the patient may be unconscious of any disorder of breathing while at rest.

When the cause of dyspnœa can be determined to be an obstacle to the free entrance of air into the lungs, the term *obstructive dyspnœa* is applied. The most frequent seat of obstruction is in the larynx, where spasm and inflammatory swelling, pseudo-membranous development, or morbid growths are the most frequent causes. Obstruction at a higher level causes less pronounced symptoms, and may be dependent upon inflammatory swelling or abscess involving the pharynx, tongue, naso-pharynx or nares, also from foreign bodies. The respiratory efforts are often attended by struggles, especially in young subjects, and it is not uncommon for the patient to make attempts as if to remove the obstruction. The breathing may be stridulous and less in frequency than normal. The seriousness of the symptoms depends upon the degree of obstruction. In high grades a fatal issue with marked cyanosis may rapidly supervene. The respiratory efforts are performed with great difficulty, and the lower portion of the chest recedes in a marked manner with each inspiratory act.

If the obstruction is in the larger bronchi of either lung, and the air does not properly enter upon that side, a variety of noises is developed, all of which is determined by means of physical examination. When cyanosis and other objective evidences of deficient supply of oxygen are apparent, the condition is sometimes designated "*inspiratory dyspnœa.*" When the difficulty attends expiration it is called "*expiratory dyspnœa.*" In this state inspiration is shortened and the expiratory effort is prolonged and difficult, the extraordinary muscles of respiration being energetically employed in extreme cases. It is observed in conditions characterized by loss of lung elasticity (emphysema), in spasm of the bronchi (asthma); in some degree it attends bronchitis with accumulated secretion, and is favored by a rigid state of the parietes of the chest.

When the sufferer must have the trunk elevated, sit up in bed, incline the body forward, or actually stand upright or move about in order to breathe, it is called orthopnœa, which condition does not have special reference to either the inspiratory or expiratory acts. The causes are not peculiar in kind, but rather intense in their action.

Rhythmic disturbances in action, the most important being the Cheyne-Stokes respiration, attend many diverse forms of disease, notably brain lesions of great variety, cardiac affections, and Bright's disease.

DISEASES OF THE BRONCHI.

ACUTE BRONCHITIS.

Varieties.—Acute bronchitis will be considered under three heads, viz.: (1) Acute simple bronchitis; (2) plastic bronchitis; (3) capillary bronchitis.

ACUTE SIMPLE BRONCHITIS.

Synonyms.—"Cold on the chest;" acute bronchial catarrh.

Definition.—A catarrhal inflammation of the larger bronchial tubes, frequently involving the trachea; the inflammatory process in most instances spreads downward from the upper respiratory tract.

The term simple acute bronchitis is applied to a catarrhal inflammation of the bronchial ramifications exclusive of the tubes of capillary size. When the latter are attacked there is presented a clinical totality of symptoms giving to that form of bronchitis such a marked individuality, as to demand a separate description. Simple bronchitis may be acute or chronic, slight or severe, and involve almost any extent of the bronchial mucous membrane. It may occur as an independent affection, or as a complication of a great variety of diseases.

Etiology.—Like all catarrhal inflammations, acute bronchitis is especially liable to appear in delicate subjects, victims of malnutrition, and those exhibiting manifestations of a tuberculous taint. Persons with strong vigorous constitutions are able to withstand the exciting causes which bring about the disease. The enfeebled constitution may be developed by long-continued debilitating disease, undue anxiety, or excessive mental or manual labor. In order also that this disease may attack the bronchi, this structure must be a *locus minoris resistentiæ.*

The exciting cause of acute bronchial catarrh is exposure to cold, especially when the cold is combined with dampness. It is therefore of most common occurrence in the changeable weather of spring and autumn. The character of the exposure varies greatly in different cases. In some there may be a severe chilling of the body from insufficient clothing; in others, getting the feet wet; and in still others, exposure to a draft of air while perspiring freely. Acclimatization is an important factor in preventing the effects of exposure. Those who have become habituated to weather changes are less likely to experience ill effects therefrom than are those not thus inured. In this climate the long periods of confinement within doors during the winter season, necessitat-

ing the breathing of the air of imperfectly ventilated rooms many hours per day, is an active predisposing factor. Bad drainage contributing to the foulness of the atmosphere of houses has a like effect. Enervating habits, a sedentary life, the wearing of too much clothing, all tend to make those accustomed thereto sensitive to the effects of cold and dampness. As might be expected, the extremes of life with their accompanying tissue irritability and impaired functional activity furnish the greater number of cases. Children who have been carefully screened from every little waft of fresh air by overanxious mothers, and who have not been permitted to take a daily airing, furnish an especially large quota. The inhalation of irritant materials, organic or inorganic, as particles of steel, dust, coal and cotton, or irritating vapors, as those of chlorine, bromine, etc., not infrequently causes simple bronchitis.

Bronchitis is a common attendant of certain diseases, notably of typhoid fever, measles, whooping cough and variola. Certain affections characterized by the accumulation of excrementitious or morbid matters in the blood, as Bright's disease, gout, rheumatism and syphilis, account for many cases.

Bronchitis also occurs as a secondary affection during the course of many organic diseases of the nervous system, as locomotor ataxia, disseminated sclerosis, paralysis agitans and progressive muscular atrophy. Under such circumstances slight exposure may bring on a very severe attack; indeed, bronchitis complicating a well-advanced organic nervous disease must always be regarded in a very serious light.

Pathology and Morbid Anatomy.—In the majority of instances the tissue changes in simple bronchitis are the result of an extension of a catarrhal inflammation occurring primarily in the upper respiratory tract. In most cases the larger bronchial tubes only are actively involved. The morbid changes are essentially those of a catarrhal inflammation of any mucous membrane. The initial lesion is hyperæmia, which varies in degree according to the severity of the attack. The mucous membrane may present in more or less limited areas an arborescent or punctiform redness. In severe forms the redness is more uniform and evenly diffused, the membrane presenting a swollen, bright red, smooth and velvety appearance. The latter is due to the swelling of the papillæ, the development of granulations, and the effacement of longitudinal rugæ. With the initial hyperæmia there occurs a diminution of the secretion of the membrane, and hence, dryness. The period of scanty secretion is a short one, being usually followed by hypersecretion, when the membrane becomes covered with a clear, transparent mucus. The character of this secretion changes with the progress of the inflammation, especially as regards its consistence and color, owing to the presence of varying proportions of desquamated

epithelium and pus cells. The alterations in color are from the early transparency to the later yellowish or greenish tints, the yellowish being due to the admixture of pus cells, and the greenish to staining by the coloring matter of the blood. Blood is occasionally found in the secretion, owing to excessive hyperæmia and a possible delicacy of the vascular walls. The blood appears in spots and streaks, very rarely in considerable quantities.

Symptomatology.—Simple acute bronchitis is ushered in by the well-known symptoms of a general "cold," such as coryza, lachrymation, sore throat, hoarseness, slight fever, headache, pain in the back and limbs, etc. In exceptional cases there may be an initiatory chill, but generally there is simple chilliness, and often an entire absence of chill or even of chilly sensations.

The temperature range is not at all characteristic. The febrile elevation is usually slight, presenting nearly always an evening exacerbation; but cases of considerable intensity as regards the extent of bronchial involvement may exist with a very moderate elevation, and still others without any febrile phenomena. The highest temperature registered rarely exceeds 101° F. or 102° F.

In many cases, pains about the chest are present. The patient experiences a feeling of rawness, soreness or oppression in the upper portion of the chest. Sometimes there are thoracic pains. All these sensations are aggravated by coughing. The sense of oppression rarely amounts to dyspnœa.

Cough is the most constant symptom. In the early stage it is dry and hacking, and may be very slight, or very frequent and distressing. It may cause loss of sleep, vomiting, involuntary urination, more or less pain in the lower portion of the abdomen, and soreness of the chest, the latter being felt particularly in the region of the sternum. With the advent of free expectoration the cough causes less annoyance to the patient.

During the earlier part of an attack of acute bronchitis the expectoration consists of semi-transparent mucus which may prove very difficult of dislodgment; but within a few days the cough becomes loose, the expectoration assuming a frothy, saline character, and, in most cases, becomes subsequently yellow or yellowish-green in color and mucopurulent in character.

Physical Signs.—These may be defined as positive or negative. Of the positive signs, râles are the most important. These vary in character according to the stage of the disease and the extent of the inflammatory process. Early in the course of the attack they are dry (rhonchi), and vary from the sonorous to the sibilant, depending upon the size of the tubes in which they are developed. With the further progress of the inflammatory process and the development of a freer and

more fluid secretion, moist râles are detectable. The character of these râles is also governed by the size of the affected tube, *i. e.*, they are coarse in the larger and fine in the smaller tubes, the latter receiving the designation of subcrepitant râles. The negative evidence of bronchitis consists in the absence of all signs pointing to pulmonary consolidation. In many of the milder cases all physical signs are absent.

Complications and Sequelæ.—Complications are not uncommon in simple acute bronchitis. They occur especially in children and old persons. The most frequent are capillary bronchitis, lobular pneumonia, pulmonary collapse, asthma, pulmonary phthisis, emphysema and circulatory changes.

Diagnosis.—The diagnosis of simple bronchitis is usually easy. The great readiness with which the diagnosis may be made sometimes leads to the serious error of overlooking graver coexisting conditions. The question arising in the mind of the diagnostician and requiring more than a casual examination to answer, is not so much as to the mere fact of the existence of bronchitis, but as to whether or not the bronchitis is attended by other lesions, such as pneumonia, phthisis, emphysema, etc. The question of an accompanying lesion is therefore of pre-eminent importance. In view of the number of cases of broncho-pneumonia and early phthisis which are mistaken for simple bronchitis, every case of bronchitis should be carefully examined for the evidences of pulmonary consolidation. Such examinations are frequently made when differentiating phthisis and broncho-pneumonia from chronic bronchitis; but they should be equally frequent during the course of what is believed to be but a simple acute bronchitis, as phthisis especially is often ushered in by the symptoms of acute bronchial catarrh. The positive diagnostic sign of bronchitis has already been stated to be bronchial râles. Their absence does not, however, negative a diagnosis of acute bronchitis, for when the larger ramifications are only slightly involved, they may be absent, and coughing efforts may also be followed by temporary absence of the râles. They are usually bilateral; when unilateral, they are indicative of localized bronchitis, which is always of a secondary character and strongly suggestive of pneumonia or phthisis. It is a common error to mistake subcrepitant for crepitant râles. Should such a mistake be made, it leads naturally to a diagnosis of beginning pulmonary consolidation. The error is possible because the subcrepitant râle is at times heard over a limited area and during the inspiratory act only, but the moist character of the latter râle, and its change upon coughing, distinguish it from the crepitant form. It is well to recall that the crepitant râle is a very fine *dry* râle, heard only during the close of the inspiratory act. A diagnosis of bronchitis must at times be made by exclusion, that is, the determination of the absence of the physical signs indicative of affections of the parenchyma of the lungs. The most im-

portant is the exclusion of pulmonary consolidation, which is the special feature of diseases involving the pulmonary structure. The beginner should never lose sight of the fact that alterations in the respiratory sounds in the direction of bronchial breathing and the existence of clearly appreciable percussion dulness, are indicative of pulmonary changes, and do not occur in simple bronchitis. The statement that distinctly appreciable percussion dulness occurs from simple accumulation of secretion in the bronchial tubes, we consider rather doubtful, believing that such dulness is always due to collapse or pulmonary consolidation, due to intra-alveolar exudation.

Simple bronchitis cannot be differentiated from *whooping cough*, excepting by the presence of the characteristic whoop in the last-mentioned disease.

Prognosis.—The prognosis of simple acute bronchitis is good, the disease never being directly fatal, excepting in the very young or the aged. Subjects of a gouty or rheumatic constitution or those in an asthenic condition sometimes exhibit a tendency to chronicity. In the aged and those addicted to excessive use of alcohol, the inflammation tends to spread to the air vesicles.

Acute bronchitis usually terminates favorably in periods ranging from a few days to a few weeks. In some cases it may pass on to the chronic form or extend to the capillary tubes or parenchyma of the lungs, the complication proving more important than the primary disease.

Treatment.—While simple acute bronchitis is usually easily controlled, there are cases which prove obstinate and protracted. If the cough, fever, etc., are not relieved with reasonable promptness, *the patient should be put to bed and confined there until the symptoms are thoroughly subdued.* The treatment differs somewhat according to the stage in which it is inaugurated. While the first stage—that of arrested secretion—is not usually very prolonged, it is frequently sufficiently protracted to demand active means for relief. The indications are to soothe the irritated mucous membrane and promote secretion. In effecting the latter, the former is also usually accomplished. Something can be done in this direction by other means than the giving of medicines. Quiet in bed, a warm moist atmosphere, inhalations of steam, and the application of hot poultices to the chest, if there exists much soreness under the sternum, etc., are all measures to which it may be necessary to occasionally resort. In the second stage—that of secretion—the quantity of expectoration may be large as well as difficult of removal. In aggravated attacks, in the previously diseased, or in the delicate, it is this stage which measures the patient's powers of endurance. The indications are to promote the early removal of the accumulating material and conserve the strength of the sufferer.

Of the medicines most frequently useful, *aconite* should be selected if the patient is seen before the inflammatory process is thoroughly established, and especially if the attack has been developed by exposure to a cold dry atmosphere. The patient is restless and irritable. More useful because more often indicated and better suited to the more fully developed condition, is *ferrum phosphoricum.* There is an absence of the restlessness, irritability, and sthenic symptoms of aconite. The sputum is freer and may be streaked with blood. *Bryonia* is called for by a tight cough which causes much soreness, and a disposition to hold the chest during the coughing effort. There may be myalgic pains and involuntary urination while coughing. *Squilla* suits fully developed cases with hard spasmodic cough, scanty expectoration and much pain in the chest. *Hyoscyamus* is valuable in the dry stage when the cough is frequent, with hyperæsthesia of the larynx and trachea. The cough is much aggravated by the recumbent position and at night. It usually acts better in the tincture. *Rumex* is adapted to the same general condition, but the hyperæsthesia is external as well as internal. The trachea is sensitive to pressure, which causes cough. *Sticta* is suggested by dryness and swelling of the mucous membrane, especially of the nose, and cough from tickling in the larynx and trachea. *Lachesis* has in a marked degree hyperæsthesia of the mucous membrane of the respiratory passages, and also more prominently than rumex or sticta, external sensitiveness to contact. When secretion becomes a prominent feature, iodide of antimony, arsenite of antimony, tartar emetic, kali bichr., pulsatilla, sulphur, stannum, etc., are more useful.

The *iodide of antimony* is well suited to most cases with a heavy yellowish muco-purulent expectoration, and is efficient in simple bronchitis, or the severe attacks of bronchitis or broncho-pneumonia developed in the course of chronic phthisis. In frequency of successful action it is the peer of any remedy with which I am acquainted. Dr. Snader reports similar experience. With enfeeblement of the heart, loud rattling breathing; for the wheezy breathing of the acute bronchitis of emphysematous persons, or with the development of cyanosis, we turn to *arsenite of antimony* or *tartar emetic. Ipecac* relieves some of these cases. *Kali bichr.* is more frequently valuable than the published symptoms and clinical experiences seem to indicate. Spasmodic cough, free expectoration of a yellow, homogeneous secretion which may be ropy, wheezing, rheumatoid pains, and a heavily coated tongue are prominent indications. Its suitableness to cases involving the larynx and trachea as well as the bronchi, is well known. In this form the voice is affected and the cough may be croupous. It is necessary to give this medicine in the first decimal trituration if the best results are to be secured. Acute bronchitis, with co-existing inflammation of the larynx and trachea, also calls for *bromine, phosphorus, spongia,* or *hepar sulph.,* according to particular indications.

Belladonna is also useful for these cases when occurring in young children. The cough is dry, spasmodic, croupy, and may occur during sleep without awaking the patient. For more extended indications for medicines consult the section upon the therapeutics of cough. *Pulsatilla*, *stannum* and *sulphur* are suited to subacute cases, with copious mucopurulent secretion.

Small doses of codeia are useful in some obstinate cases when the cough is frequent, fatiguing, causing much loss of sleep or pain, and attended by little or no expectoration.

If the expectoration is tough and difficult to expel, leading to much exhaustion, especially in old people, concentrated liquid nourishment and stimulants should be given and inhalations of steam employed. *Senega*, in five-drop doses of the tincture, repeated hourly, may relieve, but it is often necessary to resort to *ammonium carbonicum*.

PLASTIC BRONCHITIS.

Varieties.—Acute and chronic.

Synonyms.—Croupous bronchitis; pseudo-membranous bronchitis; fibrinous bronchitis.

Definition.—An inflammation of the bronchial mucous membrane characterized by the formation of a croupous exudate similar in character to that occurring in laryngeal croup and croupous enteritis.

Bronchial casts are expectorated in quite a variety of diseases, none of which should be mistaken for the one under consideration. In croupous pneumonia the casts are small and are formed in the bronchioles; in tubercular disease the casts are similar to the last-mentioned in appearance; in hæmoptysis the coagulated blood sometimes forms moulds of the bronchi, and in diphtheria the false membrane occasionally descends to the smallest ramifications of the bronchi, and may be expelled in "large trees."

Etiology.—We really possess but little positive knowledge respecting the exciting or predisposing causes of plastic bronchitis. It would seem that constitutional causes play an important part in its production; accordingly some observers have claimed that it is due to a peculiar diathesis, a view that thus far lacks the confirmation of experience. Many of the subjects of the disease are feeble and anæmic. In some cases it has been observed to succeed the bursting of cheesy lymphatic glands into the bronchi. It is met with most frequently prior to the age of forty. Its occurrence in youth and childhood seems to be a mooted point, for Wilson claims that such incidence has never been observed, while Hayn reports one case in an infant seen by him. It has also been observed to occur in persons with latent phthisical tendencies. Men are affected more frequently than are women. It is quite remarkable that all of my cases have occurred in males. As in the case of simple bron-

chial catarrh, the attacks are especially liable to occur in the spring. Sometimes the disease attacks several members of one family. This it is said to do rather by endemic influences than by contagion. Some cases are associated with heart disease, and others have followed shortly after hæmoptysis. Occasionally plastic bronchitis follows the inhalation of mechanical irritants. It is frequently associated with pulmonary emphysema. The etiological relations of these various factors to plastic bronchitis cannot as yet be positively stated, for the disease is a very rare one, and they may, after all, be merely accidentally associated conditions.

Pathology and Morbid Anatomy.—The exudate consists of fibrillated fibrin containing entangled therein various corpuscular elements, such as ciliated and cylindrical epithelium, exudation corpuscles, oil globules and granular débris. The inflammatory process may be diffused or localized, and the mucous membrane of the bronchi, particularly in the region producing the cast or casts, may be found intensely congested or pale, and the epithelium generally absent. The varying appearances of the membrane are of course due to the period of the disease at which the examination is made. The exudate is of a whitish or grayish color, and it may be either loosely or firmly attached to the mucous membrane, and is separated by acts of coughing, aided by the suppurative process. The exudate presents itself in the expectoration as casts or moulds of the bronchi, and these vary in size according to the size of the tubes in which they originate. If they come from the smaller ones, the casts are usually solid; if from the larger, they are likely to be hollow. A careful examination reveals these casts to be composed of concentric lamellæ and somewhat elastic. Acetic acid causes them to swell. They likewise vary greatly in number, because they may form in several portions of the bronchi, or they recur rapidly after expectoration. When few they are found in the sputa floating in a quantity of mucus and muco-pus. The casts in any one case present marked similarities to each other, forming as they do in the one spot, and being moulds of that particular portion of the "bronchial tree."

Symptomatology.—The symptoms of the acute form of plastic bronchitis may or may not be preceded for a variable period by those of acute catarrhal bronchitis. The formation of the casts is sometimes marked by the appearance of a chill and considerable fever. Dyspnœa becomes a prominent symptom, and its severity is governed largely by the location and extent of the inflammation. When the larger bronchi are involved, a larger portion of the lung is removed from the respiratory function, consequently the dyspnœa is great. Cough is always present, and usually frequent and straining. It is attended during its early stages with the ordinary expectoration of catarrhal bronchitis. However, in the period of full development of plastic bronchitis the severe paroxysms of coughing are followed by expectoration of the characteristic

casts. In some rare instances there is little or no cough, and an entire absence of the membranous exudate in the sputa. The nature of such a case can scarcely be suspected during life, only a post-mortem examination revealing the true character of the lesion. The expectoration of the cast or casts is usually followed by relief of the dyspnœa, and the disappearance of the fever and other symptoms, such amelioration, however, lasting only from a few minutes to a few hours, when there may be a recurrence of the same train of symptoms, which again disappear on free expectoration. Hæmoptysis frequently precedes the formation of the membranous casts; but it is usually small in quantity, and may cease with the full development of the exudate. Later, when the disease tends towards a fatal issue, there is an increase in the fever, dyspnœa, cough, and pain in the chest; there is frequent respiration, rapid and tense pulse, retraction of the chest and other phenomena of obstructed respiration, death taking place by asphyxia. The duration of acute cases ranges from three or four days to two weeks. Indications of improvement are diminution in the quantity of casts expelled, reduction of temperature and relief of dyspnœa and cough. The chronic form of plastic bronchitis is usually secondary to protracted bronchial catarrh, and is often associated with chronic pulmonary lesions of which bronchitis is a prominent symptom, such as phthisis and emphysema.

The progress of plastic bronchitis is marked by remissions, during which there may be an entire absence of symptoms characteristic of the disease. The exudate is the same in the chronic as in the acute form. Fever is not a prominent symptom, but during the periods of aggravation the temperature is for the time elevated. The symptoms are not infrequently merged with those of some chronic pulmonary trouble, hence a typical clinical picture is not common.

Physical Signs.—The physical signs found in plastic bronchitis are in the main those due to obstruction in the bronchial tubes. Vocal fremitus is absent over the affected area, and the respiratory sounds over the same part are weak or absent. After the casts have been expelled, auscultation may reveal whistling or fine moist râles over the part which had previously been silent. Percussion resonance may be diminished over the area involved, owing to a considerable accumulation of exudate in the bronchial tubes or to a coexisting consolidation of lung tissue. Usually, however, it is normal. Such consolidation may result from a broncho-pneumonia or collapse of the lobules of the lung following bronchial obstruction. In some cases the physical signs are decidedly variable, being influenced largely by the expectoration of the fibrillary plugs. Both the dry and moist râles of bronchitis frequently attend.

Complications and Sequelæ.—Not infrequently plastic bronchitis is attended by a diffuse bronchitis or a broncho-pneumonia, and it sometimes terminates in phthisis.

Diagnosis.—The disease cannot be diagnosticated unless the characteristic exudate be present in the sputa. All cases should be thoroughly examined, when this exudate is present, to determine the presence or absence of other lesions. When first expectorated the casts appear as small lumps, which assume the tree-like form as soon as floated on water. The physical signs of broncho-pneumonia or of localized bronchitis may coexist.

From *diphtheritic bronchitis* the plastic variety is readily differentiated. In the former, the characteristic exudate is first discovered on the pharynx and tonsils, and extends downward through the larynx to the bronchi. The Klebs-Loeffler bacillus is found in the exudate.

Prognosis.—In the acute form of the disease the prognosis should always be guarded. Of the acute cases statistics show that a large percentage is fatal. Several cases under my own care have all recovered. None of them attained great severity, however. Complicating factors render the prognosis even more grave than in the case of the uncomplicated disease. Complete recovery is exceptional. If obstructive symptoms are severe, the prognosis is very unfavorable. In the chronic form without complications death is rare, but recovery is equally so. The affection may persist for many years. If complications exist, the prognosis is, of course, affected according to their nature. Many cases terminate in phthisis.

Treatment.—The general treatment is conducted upon the lines laid down for the treatment of the ordinary acute and chronic forms of bronchitis. The acute form requires the same general treatment and the same class of remedies as croupous laryngitis. The first indication is found in the removal of the bronchial obstruction, and this is facilitated by inhalations of steam, which favor suppuration between the false membrane and the subjacent tissue with separation of the exudate. Emetics used to aid in the throwing off of the false membrane are depressing and are therefore objectionable, and their use should be avoided. In chronic cases, if improvement is delayed, the removal of the patient to a warm and equable climate is frequently followed by beneficial results. A sea voyage has proven successful after failure of much treatment. Every regimenal and dietetic measure should be adopted to improve the patient's nutritive status, and efforts made to modify coexisting complicating conditions. All determining causes of bronchitis should be avoided.

The drugs especially indicated are *kali bichromicum, bromine, iodine* and *spongia.* Inhalations of creasote, and especially of iodine, as suggested for the treatment of pulmonary phthisis, are to be recommended. *Iodide of potash* has been used with apparent success. Sprays of lactic acid, lime water and the alkaline carbonates are advised by some.

ACUTE CAPILLARY BRONCHITIS.

Synonyms.—Suffocative catarrh; bronchiolitis; catarrhus senilis.

Definition.—An acute catarrhal inflammation of the finer bronchial tubes.

The clear relationship existing between capillary bronchitis and broncho-pneumonia has led some recent authors to describe these affections under one head, but my experience has included forms of each affection sufficiently individualized to lead me to feel that a continuation of the separate consideration of these diseases is still justified.

Etiology.—Capillary bronchitis is a disease which is confined almost exclusively to infancy. A very few cases are encountered in old people, and are usually secondary to chronic organic lung lesions. A very small number of cases of bronchitis occur primarily in the capillary tubes, but it is usual for it to develop by extension of inflammation from the larger bronchi. As a rule the inflammation is diffuse, involving the larger number of the finer tubes in both lungs. Exceptionally the disease is limited to localized areas. The localized affection is generally secondary to some pulmonary lesion. The general causes of capillary bronchitis are essentially the same as those already given for the simple acute form.

Pathology and Morbid Anatomy.—The morbid appearances in a case of capillary bronchitis do not differ materially from those presented in acute simple bronchitis, but it should be remembered that the tubes involved are in the depths of the lungs, without cartilaginous plates, surrounded by extensive plexuses of bloodvessels, and consequently the inflammation passes through its several stages rapidly. The inflammatory process involves the entire thickness of the tubules, is attended by rapid swelling, especially of the mucous membrane, and a free secretion of mucus rich in cellular elements. As the result of the rapid swelling and free cellular secretion, the lumen of the tubules is rapidly occluded with inability on the part of the patient to secure relief by means of expectoration, even violent paroxysms of cough being insufficient to dislodge the tenacious secretion. As a consequence of this obstructive condition, the air is exhausted within certain lobules, and collapse of these lobules results, followed by a secondary inflammatory process. The richly cellular secretion is in some degree forced into the alveoli by the respiratory efforts constituting a factor in the production of consolidation.

Symptoms.—The onset of the disease varies greatly. A mild form secondary to inflammation of the larger tubes, occurs by extension, and involves only a limited area of the capillary tubes. The symptoms are those of a simple acute bronchitis. In fact, at times, the involvement of the finer tubes might not be suspected were it not for careful physical

examination of the chest. The supervention of a limited capillary involvement simply protracts the course of a simple bronchitis. Graver forms, and these are probably the more numerous, occurring particularly in children, are marked by a group of very prominent symptoms. The onset is often announced by a chill, or by repeated chills, followed by high fever, pronounced dyspnœa and drowsiness. In children the chill is often absent and the fever not very high, but drowsiness is marked. The febrile manifestations differ somewhat in children and adults, being higher and more protracted in the latter, with less disposition to a fall of temperature from deficient blood aeration. At the height of febrile excitement the thermometer may show a temperature of 103° F. to 104° F., but with respiratory failure and the occurrence of cyanosis, the fever falls, frequently to 100° F., and a subnormal temperature is sometimes reached, the frequency of the pulse and of the respiratory efforts being meanwhile but slightly, if at all, reduced. The pulse-rate in the early stage is accelerated, varying from 100 to 150 or more, according to the age and feebleness of the patient. The respiratory efforts are always very much increased in frequency, a point of diagnostic importance in the early stage. So soon as decided obstruction has occurred, particularly in very young children, the frequency of respiration becomes very great, reaching from 60 to 80 or more per minute; but as a fatal issue approaches the respiration, as well as pulse and temperature, may all diminish. With the onward progress of a serious case the most prominent feature is cyanosis, the result of deficient aeration of the blood. This symptom is usually attended by great restlessness, a failing heart, cool clammy sweat, and occasionally slight delirium, stupor, or even coma. The cough during the early stage of an attack is very frequent and hacking, and there is little or no expectoration. In adults the expectorated material is often very viscid, quite abundant, and may exhibit moulds of the finer bronchial tubes.

Physical Signs.—Percussion resonance is sometimes slightly diminished, particularly over the lower posterior portions of the lungs, while at the same time it may be abnormally resonant in the infraclavicular regions.

Auscultation. The diagnostic sign of capillary bronchitis is the subcrepitant râle, a moist râle heard during inspiration or expiration or with both acts. In the early stage sibilant râles are heard in profusion, but they mostly disappear with the advent of subcrepitant râles. If the finer tubes are extensively involved, the vesicular murmur may show feebleness or suppression, particularly over limited areas. The presence of subcrepitant râles, especially at the bases of the lungs posteriorly, is not positive proof of involvement of the capillary tubes in the inflammatory process, as the secretion sometimes finds its way from the larger into the finer bronchi by gravitation.

Complications and Sequelæ.—The more important complications are pulmonary collapse and broncho-pneumonia.

Diagnosis.—It is difficult for any one at all acquainted with physical diagnosis to mistake capillary bronchitis for any other disease, the usual suddenness of the attack, the fact of its following a simple bronchitis, the uniform bilateral distribution of subcrepitant râles, and absence from the breath sounds of any degree of the bronchial quality, the age of the patient, etc., making it almost impossible to err. Capillary bronchitis may be mistaken for simple bronchitis, pneumonia, acute phthisis, and pulmonary œdema.

To differentiate from the first two affections it is only necessary to be well acquainted with physical signs, but from the acute form of phthisis, and œdema of the lungs, it is often separated only after careful observation and the lapse of time. Acute phthisis is more likely to develop in adult life, to be attended by a high temperature, copious sweats, and marked prostration. The physical signs are more apt to be marked at the apices, which will often reveal evidences of consolidation.

Œdema involving the lungs only, suggests an investigation of the heart, as it is probably always due to cardiac disease.

Prognosis.—Diffuse capillary bronchitis is attended with great danger to life, especially in young children and old people, and also when occurring as a complication of some organic disease especially phthisis, various heart lesions, Bright's disease, emphysema, etc. The most certain indication of an unfavorable development of the disease is obstruction of the respiration. The condition of the heart should be closely watched to detect the earliest indications of heart failure, as it is from this cause that the largest number of deaths occur.

The disease has frequently proven fatal in twelve hours, especially in young infants, although the average duration is from four to six days.

Treatment.—The temperature of the room should be rather above 70° Fahrenheit, the child clothed in light wool night clothing, and carefully protected from drafts. The mouth should be cleansed frequently, the food selected with care, and if necessary, the bowels kept open by small glycerin enemas. In severe cases steam may be added to the atmosphere with advantage. Poultices and all moist or weighty applications to the chest are worse than useless. A jacket composed of two or three layers of the lightest merino, or of lightly quilted cotton, is recommended by many and may not be objectionable, but I have never been impressed by the favorable results following upon the use of any of these appliances. Frequent changes in position are opposed to hypostatic congestion.

In infants, in whom the disease sometimes very rapidly assumes

serious proportions, manifested by an abundance of subcrepitant râles (even although cyanosis may be absent), the most energetic treatment must be instituted at once to limit the inflammatory process, prevent lobular collapse, and support the strength of the patient. These indications are fulfilled by attending carefully to the food of the child, stimulating the feeble respiratory efforts by gentle manipulations and friction of the respiratory muscles, and the administration of suitable medicines. In the early stage the patient is treated in every respect as for acute simple bronchitis; but with evidence of involvement of the fine bronchi the treatment should be carefully revised. If some other medicine is not called for it is best to give *tartar emetic*, which is almost a specific medicine in typical cases of capillary bronchitis, particularly as observed in young children, experience showing its clinical results to be as satisfactory as its symptomatology suggests. It is especially indicated by the symptoms growing out of bronchial obstruction, viz., difficult breathing, loud râles heard even at a distance from the patient, or innumerable fine moist râles, defective circulation, due to heart failure and cyanosis. I have repeatedly observed success follow the use of the second decimal trituration after smaller doses have failed. *Arsenite of antimony* in the second decimal trituration has succeeded after the tartrate has failed.

Prior to the development of symptoms of obstruction *ferrum phosphoricum* is a remedy of great value, but it should never be depended upon after cyanotic symptoms appear.

Also in the early stage if there is great soreness and pain in the chest when coughing, *bryonia* will often be found sufficient to cut short the attack.

Should tartar emetic fail to afford relief, *ipecac., lachesis, laurocerasus, senega, veratrum album* or *opium* may be considered, and should be selected symptomatically.

If symptoms of gastro-intestinal irritation are present, and they frequently constitute a most annoying complication, the diet should be reconsidered, and the symptoms taken into account in selecting a medicine.

Tartar emetic often controls the vomiting, pain and diarrhœa, but *cuprum ars.* is often useful and exercises a favorable influence upon the bronchitis. *Ipecac.* and *veratrum alb.* are also to be considered for these cases.

Cases of respiratory and cardiac failure not yielding to apparently well-indicated remedies, demand alcoholic stimulation, or the use of some drug for the same purpose, the best of all being *strychnine* in grain tablets of the second decimal trituration, repeated hourly for a few hours, and then at longer intervals. In extreme cases of this kind I have obtained good results from *caffeine* used hypodermatically. The dose should vary from one to two grains according to the age of the patient,

and may be repeated hourly for a short time. Douches of cold water, or alternate ones of hot and cold water, or the warm bath, are advised when suffocation is imminent.

There can be no doubt as to the favorable influence of emesis in some of these cases, although personally I have not found it necessary to employ it beyond pushing the tartar emetic to the point of slight vomiting in some cases.

The section upon the treatment of broncho-pneumonia should be read in connection with the present one.

CHRONIC BRONCHITIS.

Varieties.—Simple chronic bronchitis; secondary bronchitis; putrid bronchitis; dry bronchial catarrh (*catarrhe sec* of Laennec); bronchorrhœa (*catarrhe pituiteux* of Laennec).

Definition.—A chronic catarrhal condition of the mucous membrane of the bronchial tubes, attended by inflammation of the entire thickness of these structures and of the peri-bronchial tissues.

Etiology.—Chronic bronchitis may exist as a simple uncomplicated affection, or it may occur secondarily to a variety of morbid conditions. It sometimes follows upon repeated attacks of acute and subacute forms of the disorder, but in the majority of such cases only when other conditions exist to favor such an occurrence. It is not an uncommon disease of the aged. Climatic influences constitute an important etiological factor, the disease being decidedly more common in damp cold localities and during the winter months. While men are far more frequently attacked than are women, it is not because of a sexual predisposition, but because they are the more exposed to the exciting and predisposing causes of chronic bronchitis. This disease is exceedingly rare in the young, but it may occur, following most frequently upon whooping cough, measles and broncho-pneumonia.

As a secondary disorder chronic bronchitis develops, in association with pulmonary phthisis, emphysema and other affections of the lung parenchyma, also heart lesions favoring pulmonary stasis, hence myocarditis and lesions of the right heart especially. It may also result from scrofula, rachitis, Bright's disease, etc.

Pathology and Morbid Anatomy.—In the initial stages of the disease the changes are confined to the bronchial mucous membrane. With the progress of time, all the bronchial structures, and even the peri-bronchial tissues participate. The mucous membrane presents a grayish or slaty color and is thickened; the mucous glands are enlarged. It is thickened and granular, and sometimes denuded of its epithelium over extensive areas. In old cases atrophic changes ensue. The entire wall of the tube becomes weakened and may undergo irregular dilatation. The air vesicles themselves may take on secondary changes and

dilate. The character of the secretion varies greatly. Sometimes there are simply small jelly-like masses of muco-pus, and occasionally these collections are of thin consistency, owing to the admixture of serum. As a result of the changes in the bronchial tubes the secretions are liable to collect in portions of the tubes which have undergone dilatation.

Symptomatology.—The symptomatic totality in chronic bronchitis presents great variations, which depend very largely upon whether or not the disease is associated with pulmonary or cardiac disease, or is engrafted on a chronic dyscrasia. The most prominent symptoms are cough, expectoration and respiratory disturbance. Later, when secondary changes take place, there are added the phenomena incident to emphysema, heart disease and visceral congestions. In the early stages, the general health may be excellent. As a rule, uncomplicated cases are unattended by fever. The cough varies from time to time, the fluctuations depending especially upon alterations in the quantity and quality of the secretions. In the majority of cases the sputum is abundant and removed with comparative ease. The inflammatory products accumulate in the bronchial tubes during the quiet of the night, and are feely expectorated at the morning paroxysm of coughing; the morning being a common time for the aggravation of the cough. With many patients, the accumulations of the twenty-four hours are removed by a few efforts, while with others the collection is so rapid that the paroxysms follow one another with but short intermission. If the secretion is tenacious and scanty, the paroxysms of cough become a prominent feature of the disease and a source of serious discomfort. In some cases the quantity of bronchial exudate is very small, a condition which may continue throughout the course of this particular form. To such the name "dry bronchitis" has been applied. What little secretion exists is tenacious and can only be expectorated after violent and frequently repeated paroxysms of coughing. In many of these cases the coughing is so violent and so racking as to excite vomiting. A variety of this *dry catarrh* is the so-called *winter cough*, which is usually associated with some degree of emphysema and heart disease. The cough is paroxysmal and especially troublesome at night. It occurs most frequently in gouty subjects.

Another class of cases is characterized by profuse bronchial secretion. To these the term *bronchorrhœa* has been applied. This variety is common among old people. The cough is aggravated at night as soon as the patient lies down, and is attended by profuse expectoration. The sputum varies greatly in its characteristics according to the presence or absence of a quantity of the "watery" element in its composition. When this is large, masses of muco-pus are observed floating in it. The quantity of matter expectorated is sometimes enormous, amounting in exceptional instances to as much as three or four pints in the twenty-four

hours. If allowed to settle, the sputum separates into three layers, the lower consisting of pus, the second of serum, and the upper of froth. Some cases of bronchorrhœa are attended with comparatively little impairment of the general health.

In simple chronic bronchitis, the expectorated masses sometimes form moulds of the tubes in which they were formed. Expectoration of blood is uncommon. The occurrence of any degree of hæmoptysis is strongly suggestive of a pulmonary or cardiac lesion. Sometimes, however, blood is found in the sputum without any lesion to account for its presence. It appears in streaks and in small quantities, mixed more or less thoroughly with the expelled material. As a rule it is without special significance.

There is also some variety in the color of the sputa. The predominating hues are grayish, yellowish, greenish and brownish. The material is but little aerated, and usually floats upon water. Occasionally it possesses a most fœtid odor, which is usually the result of long retention in sacculated bronchial tubes. In some cases the odor is so offensive as to resemble that of matters expectorated in cases of pulmonary gangrene. In consequence of the odor being greater than that observed when contents of large vomicæ are expelled, and also that disinfection or deodorization is more difficult than in disease of the pulmonary parenchyma, it has been suggested that the fœtor is due to a special ferment existing in the secretion, or developing within the bronchial walls.

Microscopically, the expectoration is found to consist of degenerated epithelium and pus cells, blood globules, granular matter, non-pathogenic micro-organisms, and small particles of the bronchial walls.

Dyspnœa is present particularly in cases of long standing. It is rarely present while the patient is at rest, but is readily developed by slight exertion, and is due to the viscidity of the secretion, the involvement of the finer tubes, the swelling of the bronchial mucous membrane, and, less frequently, to spasm of the circular fibres of the bronchi. Some cases are associated with paroxysms which simulate true asthma. At times the dyspnœa is associated with wheezing.

Physical Signs.—Inspection reveals nothing of importance in simple uncomplicated bronchitis. If secretion is great, palpation discovers a rhonchial fremitus. Percussion resonance is usually normal. Sometimes there is hyper-resonance (vesiculo-tympanitic). Some observers state that there may be slight dulness on percussion, but only over a limited area, the result of accumulation of secretion in the bronchial tubes; but that such dulness is always temporary. Auscultation shows the respiratory sounds to be normal, except in cases in which obstruction of the tubes from inflammation or its products has taken place. Over such areas the respiratory murmur is apt to be weak, or it may be for a time

suppressed. Râles are of all kinds and are often noticeable at the base where secretions accumulate. Moist râles predominate, in fact, almost to the exclusion of the dry; the latter, when present to any great extent, indicating an asthmatic complication. The râles are diffuse, heard best posteriorly, and are not localized as in phthisis. Before, however, it is definitely decided that râles are localized, and therefore indicative of phthisis, repeated examinations should be made. Vocal resonance is not impaired. Localized gurgling râles are suggestive of bronchiectasis. Around such dilatations the signs of consolidation, as found in phthisis, are absent. If well-developed emphysema is present, the chest is distended and the respiratory movements impaired.

Complications and Sequelæ.—The complications of chronic bronchitis are more serious to life than is the primary disease. All bronchitic patients are more or less emphysematous, a condition much aggravated with each recurring attack of acute inflammation, the paroxysms of cough still further distending and rupturing the degenerated lung tissue. The lesions of chronic bronchial catarrh afford a suitable soil for tubercular infection, which, in fact, not infrequently takes place. A very large proportion of patients suffering from typical chronic bronchitis are afflicted with chronic interstitial nephritis. Asthma is also a not uncommon accompaniment. Hypertrophy and dilatation of the heart occur in a considerable number of cases, and are usually secondary to emphysema. The capillary form of bronchitis quite frequently supervenes, and dilatation of the bronchi, collapse of pulmonary tissue, emphysema, fibroid phthisis, and catarrhal phthisis, are often met with as sequences. Congestion of the abdominal viscera, especially of the liver, is common, and the latter is frequently attended by ascites and, occasionally, by anasarca. Metastatic brain abscesses have occasionally followed putrid bronchitis.

Diagnosis.—The recognition of chronic bronchitis is not difficult, the elements of diagnosis differing but little from those involved in the acute disorder. It is easily separated from an acute attack by the clinical history of chronicity and the absence of decided fever. Bronchitis being present, the question arising in the mind of the physician is, "Is it simple or complicated?" The common complication is phthisis. In the incipient stage of the last-mentioned disease, careful and repeated examinations are required to determine its existence or non-existence. The clinical history cannot be depended upon to decide the question, for the physical signs constitute the only reliable guide. In the simple form of bronchitis the general health is not seriously impaired so long as complications are absent. Serious loss of flesh, therefore, warrants suspicion of the existence of pulmonary trouble. In all cases thorough examination of the patient is required to recognize the presence of gout, nephritis or heart disease. Fœtid bronchitis may be mistaken for gan-

grene of the lung. The presence of hæmatoidin crystals, blood pigment, shreds of lung tissue and cholesterin crystals in the sputum favors the diagnosis of lung disease. The presence of cavities is to be recognized by the physical signs.

Prognosis.—The prognosis in chronic bronchitis should be given only after careful, perhaps repeated examinations, not only of the respiratory apparatus, but of the circulatory and urinary organs as well as of the liver and stomach. Simple bronchitis is seldom, if ever, fatal. Death occurs only in consequence of coexisting lesions. Advanced age, any of the pulmonary complications, organic disease of the heart, but especially mitral insufficiency and fatty degeneration, or even a serious impairment of general nutrition, warrants a guarded prognosis.

Course and Termination.—The termination of chronic bronchitis, if not uncomplicated, is that of the accompanying lesion. It is seldom continuous in its progress, but presents in the early stage a succession of waves of aggravation with intermediate periods of approximate health. Cases improve greatly in summer to relapse on the return of cold weather. These periods of improvement gradually diminish in frequency and length, until finally the disease becomes firmly established. But even after full development, acute exacerbations are frequent, cold and damp seeming to possess the most damaging influence. Complete recovery is rare.

Treatment.—An equable temperature and a pure atmosphere are the most important adjuvants in the treatment of chronic bronchitis. Next in importance are personal hygiene and attention to general nutrition. Patients unable to avail themselves of climatic advantages should remain in-doors during cold, damp and changeable weather. Those who can seek a favorable climate should choose a locality where the prevailing temperature is equable and moderately warm, the atmosphere pure and dry, and the altitude comparatively high—such, for instance, as we find in Southern California.

During the progress of treatment of chronic bronchitis the determining causes of the disease must be ever borne in mind. Direct treatment may sometimes prove advisable, and includes the disinfection of the secretions, measures looking to their diminution, and the control of the cough. The general treatment must include a full recognition of the complicating lesions. The diet should always be nutritious and easily assimilable. Alcoholic stimulants are rarely of service in simple cases, but may prove useful temporarily when pressing symptoms due to cardiac disease are present. Consequent upon the great variety of associated affections, the symptomatology of chronic bronchitis presents great variations, and necessarily demands the employment of a much larger class of drugs than in the less complicated acute disease. But those who rely upon drugs alone in its treatment will meet with frequent

disappointment. It is only by the best attainable combination of hygienic, climatic and medicinal measures that obstinate cases can be controlled. All useful measures should, as far as circumstances permit, be in force at one time, and be continued for a considerable period after apparent recovery.

A great number of remedies have been recommended as useful in chronic bronchitis, and, as before stated, the variety of clinical associations of the disease renders the reason for this perfectly clear. The selection of the remedy must involve more than mere symptom matching. It is always imperative that due weight be given to the relation of the drug selected to the lesion which underlies the bronchitis, for while intercurrent remedies applicable directly to the bronchial symptoms must at times be prescribed, better results are attained when the symptomatic totality of the primary condition is included in making up the prescription.

The appended indications for medicines used in the treatment of bronchitis are of a very general character, as, clinically, it is impossible to completely separate the various forms and furnish separate indications for each without much repetition.

No group of medicines is more frequently of value in the treatment of bronchitis than iodine and the iodides. *Iodine* is a useful remedy in bronchitis, particularly as occurring in phthisical patients. It seems best suited to cases with little expectoration (dry bronchitis), to a dry, hacking, fatiguing cough, and rapid emaciation even while taking plenty of food. Its use by inhalation is often followed by benefit. The best results attend the use of the first decimal dilution or even the tincture. Foremost in importance is the *iodide of antimony*, a drug which was introduced into the materia medica by the author and recommended by him as a remedy for bronchitis, especially of the phthisical and influenzic varieties. It has rapidly gained high favor, such a large number of cases having been treated as to permit of deductions of value as to its usefulness to be made from clinical experience. Spasmodic cough aggravated especially in the morning and often at night, and attended by a free expectoration of muco-purulent matter of an indifferent or sweetish taste, attended by rapid loss of flesh and strength, and by night sweats, are the most important indications. If the cough is fatiguing by reason of frequency and severity, some other remedy is often required for preliminary use. One-grain tablets of the second decimal trituration, frequently repeated, is the best form of administration. The *iodide of tin* is a remedy of the first value in bronchitis especially of the chronic type, if expectoration is copious, easy, and of a dense muco-purulent character. It seems equally suitable whether bronchitis is simple in character or associated with phthisis, bronchiectasis, or other destructive process. The indications are based largely upon those calling for *stannum metallicum*, which remedy

is less frequently useful. It has been most used in the second decimal trituration.

Iodide of arsenic is employed mostly for the bronchitis attending pulmonary phthisis, especially in the earlier stages of the disease. It is indicated by anæmia, dyspnœa, debility with rapid loss of flesh, and a pale waxy-looking skin.

The *arsenite* of *antimony* is suitable to the most acute as well as the most chronic forms of bronchitis. In the acute form, as seen in connection with influenza and some cases of pneumonia, it is especially valuable when there are loud râles heard even at a distance from the patient, dyspnœa, feebleness of the circulation, and an anxious, restless condition. In the chronic variety, when dependent upon emphysema, heart affections, etc. It is indicated by asthmatic breathing, inability to lie with the head low, or even to lie at all. I have employed the second decimal trituration almost exclusively.

Arsenic suits a great variety of forms of chronic bronchitis, but especially those attendant upon valvular disease of the heart, emphysema and Bright's disease. There are continuous dyspnœa, or asthmatic attacks, weak heart, pulmonary œdema, marked debility, anæmia, dropsy, restlessness and anxiety. Arsenic is suitable to some cases of dry bronchitis.

Tartar emetic is one of the most valuable remedies in the materia medica for the treatment of acute bronchial catarrh particularly when involving the finer bronchi. It is also of use in chronic bronchial inflammation, but more especially for the subacute exacerbations occuring in the bronchitis attending emphysema and other chronic lung affections. It is indicated by coarse moist râles, without free expectoration, and defective aeration of blood. When the cyanotic symptoms are due to the heart and not to bronchial obstruction, tartar emetic is seldom beneficial.

Ipecac. is indicated for the acute bronchitis of children, when attended by coarse râles, vomiting and defective aeration. It is one of the first remedies to be considered when asthma supervenes upon bronchitis (partly neurosis, partly inflammatory).

Grindelia robusta is applicable to either acute or chronic bronchitis, but especially to the latter form when attended by dyspnœa or paroxysmal difficulty in breathing (asthma). The cough is dry, and expectoration slight or absent, although there may be coarse râles.

Senega is called for by copious, tough secretion, expectorated with difficulty. The cough is dry, paroxysmal, and aggravated at night. *Senega* acts much more favorably in five-drop doses of a good tincture.

Ammonium carb. for the bronchitis of old or feeble individuals who have much secretion which is expectorated with difficulty, or which the patient makes little or no effort to remove. Marked failure of the respiratory and circulatory functions is the chief indication. There

are coarse mucous râles and oppression. Carbonate of ammonium is valuable in the chronic bronchitis associated with heart or kidney disease, bronchiectasis, or the various cachexiæ. It is most valuable in the lower dilutions, but must sometimes be given in substantial doses to secure the best results. The *iodide of ammonium* is applicable to the bronchitis of rachitic or tuberculous children who have feeble circulation, enlarged lymph glands, etc.

Aconite is often indicated in the early stage of acute bronchitis, the inflammation often involving the larger tubes and the larynx. Given in the first decimal dilution it may afford relief to the difficult breathing and develop secretion.

I can recommend Meyhoffer's suggestion of *aconite* for dry, spasmodic, annoying cough, attended by dyspnœa which occurs in paroxysms, especially in the morning and evening (dry bronchitis), and often of considerable standing.

Bromine is serviceable in acute bronchitis when associated with catarrh of the larynx and trachea and a croupous cough. I have found this remedy particularly useful in treating some cases of the bronchial form of influenza. The high volatility of bromine is a barrier to its successful use, as it is difficult to administer doses of regular strength. This is largely overcome by using a dilution prepared with simple syrup.

Spongia is suitable in some cases of chronic bronchitis when associated with laryngo-tracheal catarrh. The cough is dry, ringing, metallic, high pitched, and attended by little or no expectoration. The breathing may be asthmatic in character.

Phosphorus may be indicated in the simple acute form by a dry hacking cough, much tickling in the larynx, little expectoration and hoarseness; also in some cases of the capillary variety, especially as seen in adults. In a few cases of chronic bronchitis with an aggravated morning and evening cough, and a small quantity of sweetish, yellowish, muco-purulent secretion, it gives good results. Phosphorus seems best suited to thin, feeble, degenerate individuals with a tendency to fatty metamorphosis.

Rumex crispus is efficient for some cases of dry bronchitis, characterized by marked hyperæsthesia of the mucous membrane of the respiratory tract. The cough is excited by tickling sensations in the trachea and primitive bronchi, and is much aggravated by breathing cold air, eating, talking and the lying position. Twenty drops of the tincture in four ounces of water, in teaspoonful doses frequently repeated, is the method of administration I would advise.

Lachesis sometimes relieves after the failure of rumex.

Sanguinaria. Bronchitis associated with a good deal of fever, free expectoration, flushed cheeks and afternoon aggravation. There are dyspnœa, burning and pressure in the chest, myalgic pains, or articular pains and swelling.

Drosera. Cough of a spasmodic character, attended by "whooping," retching and vomiting, is met as a persistent condition in some adults, especially neurotic women, as well as in the infectious cough of children, and in many instances is well met by this medicine.

Apomorphia, in the second decimal, grain doses repeated every one to three hours, sometimes helps dry irritating coughs attended by gagging or vomiting.

Calcarea carbonica is prescribed upon its general well-known indications and proves an invaluable medicine in the course of most cases of chronic bronchitis in feeble children. It is more often called for in rachitic or tuberculous children, or in those manifesting feebleness of assimilative power. The child is often inclined to be fat, is pale and flabby, sweats much, especially about the head, has enlarged lymphatics, enlarged abdomen, dry light-colored stools, and sometimes an offensive diarrhœa.

Lycopodium. Contrary to the opinions of many, lycopodium is an efficient remedy in many cases of chronic bronchitis. It is in cases associated with phthisis, various pulmonary affections, and the gouty state, that its administration is followed by the best results. Acid dyspepsia, flatulency, uric acid in the urine and constipation are conditions suggesting its use. The higher dilutions are most employed, those who do not have confidence in the activity of such preparations being disposed to avoid the remedy, but in the lower triturations lycopodium is by no means the inert remedy which many suppose.

Sulphur. Chronic inflammation of the mucous membranes, regardless of location, calls strongly for sulphur. It must be selected upon its general indications, which are well laid down in the materia medica, but are too numerous for repetition in this place. Sulphur should be considered for any case of refractory chronic catarrh.

Pulsatilla. Chronic bronchitis with a moist cough and profuse easy expectoration of yellowish or greenish muco-purulent matter, especially when developing in anæmic females who are troubled with menstrual disorders, is frequently controlled by this remedy. Such persons may manifest the gouty diathesis, have anorexia, dyspepsia with bad-tasting eructations, erratic pains, chilliness and mental depression.

Sepia is indicated in some cases of chronic bronchitis in women who suffer from coexisting uterine disease, congestion of the portal system and its results. The rich collection of subjective symptoms belonging to this remedy furnishes groups often met with in sufferers from chronic bronchitis.

Silica is a much-neglected remedy. For phthisical bronchitis, with associated cavities, bronchiectasis, highly purulent sputum, fever and profuse general night sweats, it often proves a capital medicine. Silica does not afford much relief from cough which is in excess of what is required for expectoration.

Kali bichr. has been prescribed mainly upon the character of the expectoration, which is of an exceedingly stringy character. The breathing may be wheezy, the patient being forced to sit up on account of the choking sensation. *Kali carb.* is preferable when there is a marked early morning aggravation (3 to 4 A.M.), with dyspnœa, stitches about the chest and asthmatic breathing. The cough may be spasmodic, attended by gagging or vomiting, and with inability to expectorate. The cough is often dry with stitches in the sides. Highly characteristic indications are the 4 A.M. aggravation, œdema beneath the eyebrows, weakness, coldness, emaciation. *Kali carb.* is better suited to the chronic form of bronchitis.

Kali hydr. is suitable to the chronic bronchitis of the cachectic especially of the syphilitic. In two cases of chronic bronchitis, associated with syphilitic disease of the lung, its use was followed by complete restoration. It is often necessary to give this drug in full doses.

Causticum has not proven as valuable in my experience as observers of the past have recorded. Hoarseness, inability to expectorate the secretion, which must be swallowed, involuntary urination while coughing, pains of a rheumatic character, aggravated by every change in the weather, better from the heat of the bed, the gouty constitution, uric acid in the urine, and acid dyspepsia, are the more important symptoms and conditions calling for this remedy.

Chelidonium is little used, but often beneficial, in chronic bronchitis associated with gastro-duodenal catarrh, various affections of the liver and jaundice. The cough is spasmodic, aggravated in the morning, and attended by rattling and free expectoration, which is dislodged with difficulty. There may be stitching pains, aggravated by deep breathing and motion, and the various symptoms of hepatic disease.

Benzoic acid. Chronic bronchitis in gouty individuals, with high-colored, offensive urine or asthmatic symptoms. I have had good results from the *benzoate of lithium* and *benzoate of ammonium*, in the chronic bronchitis of dyspeptic persons, with catarrh of the urinary tract, and the various evidences of lithæmia.

Hepar sulph. is indicated by a loose cough, which is aggravated at night, especially in the morning hours. It may have a croupous sound. Expectoration may be quite free and muco-purulent, or there may be a good deal of rattling with but little expectoration. The tendency of small injuries to take on suppurative action is a valuable accessory indication. I have often found this remedy valuable in the bronchitis of phthisis when administered frequently and for long periods, in grain tablets of the pure sulphide of calcium.

Atropine helps some cases of chronic bronchitis with little or no expectoration, cough periodically aggravated, especially at night, with asthmatic wheezing breathing during the paroxysms. A prominent

nervous factor is usually apparent. In frequently repeated doses of the third decimal dilution very gratifying results have been obtained.

The *arsenite of quinine* is often temporarily valuable in chronic bronchitis with free expectoration, not much useless cough, but febrile symptoms manifesting periodicity. Tablets of the second decimal trituration are the best medium in which to dispense this medicine.

Baryta iod. I have found fresh triturations of this medicine useful in the chronic bronchitis of strumous children, especially if subjects of tonsillitis or glandular swellings.

Cactus grand. has relieved persistent bronchial catarrh when associated with heart conditions calling for this medicine. In such cases the cardiac condition is primary.

Conium mac. The action of conium upon the glandular system and the resemblance of the cough characteristic of this drug to that produced by the pressure of enlarged bronchial glands upon the pneumogastric, has led to its employment for cough of this character. My own experience with it is slight.

Carbolic acid, both by inhalation and internally, is of the first importance in chronic bronchitis attended by profuse purulent expectoration (fœtid bronchitis; bronchiectasis; phthisis).

Natrum sulphuricum. For chronic bronchitis in persons when symptoms are aggravated in wet weather. Asthmatic symptoms may attend. The patient is inclined to sit up and hold the chest with both hands, to lessen annoyance due to breathing and coughing.

It is of importance in all cases of troublesome cough to note with care the time of aggravation, if such exists, not so much for the purpose of determining the appropriate remedy, although this is important, but rather to learn the cause of the aggravation and adopt preventive measures. It will prove surprising to one who has not treated cough in this critical way to see how frequently the periods of increase can be related to fever, exercise, eating too much, or of improper food, or at unsuitable hours; imperfect ventilation, tobacco smoke, or other strong odors; the effort of disrobing, particularly in a cooler atmosphere than the patient has been sitting in; getting between cool sheets, too much talking, etc. Medicines are inefficient as long as such exciting factors are allowed to remain operative.

Opiates. No practice can be worse than a ready resort to opiates in the treatment of cough, and yet the author confesses that he sometimes meets cases which he cannot treat satisfactorily to himself without a resort to them. But it is seldom necessary to make use of such remedies long. It is emphatically for the early stage of bronchitis, before secretion has relieved the turgid mucous membrane, that opiates are most likely to be demanded. Of all forms codeine is the best. It can be administered in doses of one-twentieth to one quarter of a grain.

Inhalation treatment. In chronic bronchitis with free expectoration, especially if the secretion is putrid, the employment of creasote, eucalyptus, terebene and other antiseptic agents by inhalation (as recommended in the article upon pulmonary phthisis), should be considered. Of all agents employed for this purpose creasote is the most important. Care should be taken to secure a first-class article made from beechwood. Such inhalations will also frequently give relief from fatiguing cough with little or no expectoration. The inhalation should be continued one hour and be repeated two to four times during the twenty-four hours.

BRONCHIECTASIS.

Definition.—A dilatation of one or more of the bronchial tubes, which may be general, involving an entire tube, or localized.

History.—This pathological condition never occurring as a primary disease, escaped recognition in the midst of associated morbid changes until it was observed and described by Laennec. Since his day but little has been observed that adds to the knowledge he gave us concerning it.

Etiology.—The statement above made, to the effect that bronchiectasis is never a primary clinical entity, requires some modification, a modification depending upon a very rare contingency, namely, the presence of dilatation of the bronchi as a congenital condition. Other than this, it is secondary to other respiratory diseases, and most frequently to chronic bronchitis, and next in decreasing order of frequency, to phthisis, catarrhal pneumonia of children, foreign bodies in the air passages, and pressure of tumors, such as aneurism, on one of the bronchi. It is not uncommonly associated with interstitial inflammation of the lungs. It may arise in the course of atelectasis pulmonum.

Pathology and Morbid Anatomy.—Bronchiectasis may involve one or more of the bronchial tubes, and may be either cylindrical or saccular. The former variety includes those cases in which the enlargement affects the tube through its entire length. It is quite uniform, extending even to the terminus of the tube immediately beneath the pleura; it may even happen that the tube increases in calibre as it descends. The calibre of the affected tubes may be very irregular, made so by fibrous bands, trabeculæ and thickening of the bronchial walls. This last-named condition, thickening of the bronchial walls, is the ordinary one in the cylindrical variety. The medium-sized and smaller tubes are generally the ones involved. Cylindrical bronchiectasis may fail of recognition at the autopsy because of the dilated tubes being mistaken for the normal tubes of large calibre. This error need not arise if care is taken to note the size of the tube into which it opens and to institute comparisons with the same.

The sacculated variety of bronchiectasis appears as localized enlarge-

ments at the extremities of or along the course of the tubes. The walls of the bronchi are thinned within the dilated area. The dilatations are usually multiple, and range in size up to that of an orange.

The mucous membrane in the cylindrical variety is thickened, catarrhal and covered with a muco-purulent discharge. It is readily broken down. In sacculated bronchiectasis the mucous membrane presents a smooth, shining appearance and is thinned, owing to the stretching to which it has been subjected.

Dilatations of the bronchial tubes usually form as the result of the mechanical effect of expiratory efforts, as in coughing, upon tubes already weakened by disease. The accumulation of secretion in long-standing pulmonary diseases also tends to favor the condition in the same way, and, in addition, the retained matters produce local changes by soakage. When bronchiectasis is secondary to interstitial pneumonia and atelectasis, however, it is the result of traction on the bronchial walls by cirrhotic lung tissue and collapse of the pulmonary vesicles. This view, however, is antagonized by Grainger Stewart, who says that the first condition necessary is one of atrophy of the bronchial tissues, and that fibroid changes in the lungs frequently follow therefrom. The pressure of air in the tubes can then produce the dilatation.

The mucous membrane of the dilated bronchi sometimes ulcerates; in fact, it may become the seat of tubercular ulceration. A necrotic surface may be formed, the destructive process extending entirely through the affected part and into the parenchyma of the lung; a cavity is thus formed, the walls of which consist partly of bronchial and partly of lung tissue. The recognition of the dilated bronchi is readily made post-mortem. The cut surfaces of the lungs disclose numerous tubular orifices, which may be readily opened with the scissors. Sometimes bands of connective tissue traverse the walls of the dilated tube. The sacculated bronchiectases appear as small cavities with walls of bronchial mucous membrane. Fagge describes the latter as like small saucers in the midst of the lung substance.

Hamilton believes that many cases arise from inhalation of dust and foreign bodies in a fine state of subdivision. He says that these particles "first penetrate through the infundibula, air vesicles and smallest bronchi, and from these they are poured into certain of the peribronchial lymphatics, but mostly into the larger lymphatics around the arteries. From the peri-vascular lymphatics they run into the lobular septa, from this to the deep layer of the pleura, and finally into the bronchial glands." A large amount of fibrous tissue is formed, the cicatrization of which results in irregular dilatation of the tubes.

By some pathologists a relation between pleurisy and bronchiectasis is traced.

Symptomatology.—Many of the symptoms attending bronchiectasis

are dependent upon the primary malady, *e. g.*, chronic bronchitis, phthisis, etc., as the case may be. The supervention of bronchial dilatation upon one of these diseases results in intensification of its symptoms, although when the dilatation of the tubes is of but mild degree there may be no clinical phenomena to suggest its presence. In marked cases there are always symptoms which suggest the presence of bronchiectasis, which are found especially in the character of the cough and expectoration. From the description of the morbid anatomy of bronchiectasis it will be readily understood that it is not only possible but very easy for the muco-pus to collect in the dilated parts until the same are filled and ready to overflow healthy structures. This fact impresses itself on the cough and expectoration. For hours the patient experiences no trouble until the healthy mucous membrane is irritated by the bronchial accumulation, which, coming in contact with it by overflowing the retaining walls, or by reason of a change in position, violent coughing ensues with expectoration of large quantities of very fœtid sputum. For reasons which are apparent, cough and expectoration are freer in the morning. The sputum is grayish or grayish-brown in color. Osler describes it as having a "peculiar acid, sometimes fœtid odor. Placed in a conical glass it separates into a thick granular layer below and a thin mucoid intervening layer above, which is capped by a brownish froth." Microscopically the sediment is found to consist of pus corpuscles, the crystals of fatty acids, and when ulceration has taken place, crystals of hæmatoidin and elastic fibres. The fat crystals are not characteristic of this condition, however, but are present in any discharge of unhealthy pus from the lung. They appear as needles, single or in groups. Von Jaksch has found them in masses expelled from the tonsillar crypts. They must not therefore be looked upon as of much importance.

Physical Signs.—The physical signs of bronchiectasis are by no means constant or positive. The presence of larger râles in a portion of the lung than the normal calibre of the tubes there situated would permit, is suggestive. Then, too, signs differ according to the position of the dilatation, the condition of the surrounding lung substance, and the quantity of secretion within the cavity. Large saccular dilatations present signs very closely simulating those of phthisical cavities. They are usually situated at the base of the lung, and are unilateral.

Diagnosis.—The character of the expectoration in connection with its periodical expulsion, constitutes the strongest evidence of the existence of bronchiectasis. Phthisis is the complaint commonly mistaken for it. At times a differential diagnosis may be impossible. The apices of both lungs are usually involved in phthisis. Stokes calls attention to the importance of studying the progress of the physical signs. In phthisis, we have first dulness, then cavity; in bronchiectasis, first cavity, then

dulness. Microscopic examination of the sputa may afford some aid, tubercle bacilli being present in phthisis and absent in bronchiectasis, but the latter is often associated with phthisis.

Prognosis.—The prognosis depends not so much upon the bronchiectasis as upon the degree of development of associated lesions. Naturally, this condition adds to the seriousness of the primary disease whatever it may be. Bronchiectasis is not inconsistent with a long period of life.

Treatment.—The treatment of bronchiectasis is that of the causative pathological condition. It is useless to expect to cure the dilated bronchi, or even to arrest the morbid process unless causative indications are considered. To allay cough by sedatives when the dilatations are filled with an offensive accumulation, is in the highest degree irrational; rather do what we can to promote the cough and keep the diseased tissues clean. "Coughing down hill" has been recommended in high terms. The patient is directed to assume a position such that the body assumes a steady decline, the head and shoulders being lowest, *e.g.*, the legs and abdomen resting on a couch while the head and shoulders hang over the end and near the floor. Coughing in this position secures the aid of gravity in the expulsion of the sputum.

The use of antiseptics locally may be necessary in some instances to relieve the fœtid expectoration. Of these, creasote, carbolic acid, and permanganate of potash may be used as inhalations, sprays, etc. In irremediable cases surgical measures have been recommended and practised, although they offer but slight hope. Grainger Stewart employs intratracheal injections. The proportions he uses are: Menthol, 10 parts; guaiacol, 2 parts; olive oil, 88 parts. Of this one drachm is injected into the trachea twice daily, with the result of causing rapid diminution of fœtor and improving all the symptoms.

The remedies indicated in these cases, the reader will readily surmise, are those suggested by the symptoms of the primary condition, for, from a pathological standpoint, there is no place for homœopathy in the treatment of a bronchiectasis *per se*. The remedies recommended under phthisis pulmonum and bronchitis will always need consideration. Meyhoffer has especially praised *sulphur*, *stannum*, and *calcarea* as efficient when the bronchial tubes are dilated. The symptomatologies of these drugs and experience bear testimony to the value of his recommendations. *Carbo vegetabilis* and *silicea* justly enjoy professional favor. I have had the best results from the use of *stannum iod.*, 2x, and *hepar sulphur* in material doses.

ASTHMA.

Definition.—Asthma is a generic term, being applied with qualifying words to a variety of conditions, in which dyspnœa is the most prominent

symptom. The present tendency is to restrict the use of the word asthma to the form known as bronchial or nervous asthma, which is an affection of neurotic origin, represented by attacks of dyspnœa, due to spasm of the circular muscular fibres of the bronchi, and probably also of the respiratory muscles, and, in some cases, or perhaps in some degree in all cases, hyperæmia of the bronchial tubes. Attacks are excited by a variety of agencies capable of direct irritation of the mucous membrane of the bronchial tubes, and by reflex irritation from some distant organs.

Etiology.—Writers are nearly a unit in the view that asthma is a neurosis. The most prevalent theory, that propounded originally by Dr. C. J. B. Williams, of London, is that the attacks are the immediate result of spasm of the circular muscular fibres of the smaller bronchi, the predisposing cause consisting of a morbid sensitiveness of the nervous apparatus of the lungs. Recently certain authors (prominently, Traube and Weber) have ascribed the attacks to hyperæmia, and specifically to a turgescence of vaso-motor origin. Kruse has recently attributed asthma to a morbid condition of the bronchioles themselves, claiming that treatment directed to alteration of supposed sympathetic organs has in most instances failed. Curschman found in the sputum of persons suffering from asthma grayish or grayish-yellow tough threads or spirals. These threads are often wound around each other many times. They are found in the minute bronchial tubes, and are supposed to represent a special form of bronchitis, but are not peculiar to asthma, as Vierordt found them in croupous pneumonia, and Escherich, in plastic bronchitis. Extended observations by Schmidt revealed fibrin in the sputum of most cases. This observer believes the spirals to be due to the whirling of the air during violent coughing or long paroxysms of dyspnœa. It seems probable that these three conditions, *i. e.*, muscular spasm, hyperæmia and catarrh, may each be factors in some degree in different cases, but that there is often no evidence of catarrh, and from the sudden onset and very rapid relief which occurs in some cases of asthma, that hyperæmia can hardly be considered as the cause of the attack. The influence of uric acid in causing asthma is being advocated by Haig and others. The reflex origin of asthma has been much studied in recent years, with the result of learning that it may be excited by disorders of most organs and regions of the body, more especially, however, by disorders of the abdominal and pelvic viscera. We have elsewhere referred to the prominent influence of nasal and naso-pharyngeal causes, as well as of enlargement of the tonsils. Irritation of the nasal mucous membrane with pulverized ipecac and other irritating substances may cause an attack of asthma. Heredity exercises some influence. Neurotic "well-to-do" families produce most asthmatics. Rachitic, scrofulous, syphilitic and anæmic persons also seem to be predisposed.

Males are more often attacked than females. The disease is quite

frequent even in early childhood, although most cases develop between the years of adolescence and middle life. Cold damp changeable weather is an exciting cause; the especial prevalence of the disease is, therefore, during the cold months of the year. Irritation of the pneumogastric nerves by tumors, swollen lymphatic glands, etc., and especially enlargement of the bronchial glands in children, are occasional causes. A relationship between asthma and skin diseases has been apparent to some. Most extraordinary and curious are some of the exciting causes of asthma. Certain odors, as of some flowers, animals, etc., may cause an attack in asthmatic individuals, while others are asthmatic only after smelling a given odor. Some are relieved by a residence in the smoky, dusty city, while others are better in the country. Mental perturbation even may develop an attack. After long continuance of the disease the bronchitis attending the emphysema which has been developed, becomes an exciting cause, partially through the greater sensitiveness of the patient to climatic influences.

Dyspnœa of an asthmatic type occurs as a sequence of heart disease, especially of mitral insufficiency, and also of certain toxæmic conditions, such as uræmia, gout, etc.

Symptoms.—Asthmatic attacks consist of paroxysms of dyspnœa, which, in typical cases, are truly intermittent, and which more often occur at night. Prodromes are occasionally present, but, in the majority of cases, the patient retires in his accustomed health to awaken within a few hours with difficult breathing which more or less rapidly assumes the characteristics of this well-known disease. At the height of the attack the distress is great. The extraordinary muscles of respiration are called into active use. Expiration is especially interfered with, oonsequently there is a long, difficult, wheezy expiratory effort. The respirations are not increased in frequency. The face is pale and may soon become cyanotic, and the appearance one of anxiety. Speech is in monosyllables. The extremities are cool and a clammy sweat may cover the body. At first there is a dry cough, which, later, is accompanied with expectoration which is raised with difficulty. Besides the spirals of Curschmann, there are found, upon microscopical examination of the sputum, crystals resembling a " double pyramid " (Leyden's asthma crystals). A similar crystal has been described as present in leucocythæmic persons (Charcot; Neumann). These asthma crystals have been discovered in phthisis, as well as in various forms of bronchitis, in empyema, and in the semen.

After the obstruction to breathing seems to have reached an unendurable degree the patient begins to breathe with a little more ease, coughs more and easier, and may soon fall asleep, perhaps to awaken with a second attack, or relief may continue until the following night, or even longer. Upon inspection one is at once impressed by the violent muscular efforts and the proportionately slight expansion of the chest.

The intercostal spaces are distended and the entire chest is apparently and actually enlarged, as shown by comparative measurements. The diaphragm is depressed, tense and moves but slightly. If the percussion note is altered, it is hyper-resonant. This is always true in cases of long standing, which have developed emphysema. Auscultation reveals a weakening or absence of vesicular respiration, and râles of all kinds in abundance. These are more marked during expiration. Early in the attack they are dry, later, as relief approaches, they become moist. The inferior and anterior borders of the lungs are carried downward and forward, the border of cardiac dulness being correspondingly diminished. The liver is depressed, as may be readily discovered upon percussion. These physical changes are due to the distended state of the lungs. With relief there is a rapid restoration to normal relationships, but with frequently repeated attacks the abnormal condition becomes a permanence, due to the development of emphysema. During attacks the heart's sounds are enfeebled, this being a result of the interposition of more than a normal amount of lung tissue between the heart and the chest wall.

Prognosis.—The course of asthma varies greatly. No matter what the character and circumstances of the early attacks, one cannot prognosticate with any certainty the future of a case. The asthma-like paroxysm found in the child, apparently due to cold or other ordinary causes, may be the beginning of a life of suffering. In others a violent form, and even when continued for a time, may be followed by complete restoration. There is possibility of control and recovery before the lungs and heart are organically involved, and even after that event the attacks may cease, sometimes spontaneously. The use of various powerful remedies, whether given internally or locally by inhalation, as in "smoking," etc., is prejudicial to recovery. Hope of recovery depends much upon the nature of any primary affection which may be present. Death rarely occurs during the paroxysm, but rather from chronic sequential affections, such as emphysema and the consecutive cardiac changes, the latter leading to obstructed circulation.

Treatment.—Douglas Powell truly says that "there is no disease so extensively quacked, for asthmatics are often of nervous type, with little faith, many friends and much credulity." In every case of asthma most exhaustive search must be made to discover the cause, and then to address treatment to the same, at the same time religiously avoiding the use of powerful remedies in vogue because they afford such immediate relief. Goodhart, in his admirable Harveian lectures upon the "Common Neuroses," referring to asthma, says: "When I study this disease in a comprehensive way it seems to me as nearly certain as can be that it is the direct result of cultivation, and, in its worst forms, often of our methods of treatment. Asthma can be nursed into a very terrible

disease, and often is so." Out-door life, change of residence if necessary, well ventilated and well lighted apartments, the regular use of cold sponge bathing, proper exercise and food, light evening meals, and a most careful study of the digestive organs, disorder of which almost always excites the asthmatic paroxysms, and everything tending to improve nutrition, should be employed in the early stages of the disease. These suggestions are so trite, however, that they receive little attention from most practitioners, or indeed from the patient. Several cases I have known to experience great or entire relief as long as they lived in certain climates, especially upon some of the high, dry western plains. This is contra-indicated if emphysema and heart trouble exist. A small percentage does better at the seashore, or from a sea voyage. Kruse has recently emphasized the value of sea air, ascribing the good influence to the density of the air, the absence of dust and the higher percentage of moisture. A "rest-treatment" has proven useful in broken-down individuals, and proper diet and methods of exercise in uric acid cases. Sedative and anti-spasmodic remedies should be avoided, but this is not always possible, as the patient may have been addicted to their use for a long time, prior to coming under treatment; or the case may have proven incurable under the best treatment, when anything may be done to relieve. Fumes of nitre, stramonium, chlorate of potassium, or tobacco, combined variously, are in common use, and often are very efficient in giving temporary comfort. Nothing better can be said of chloroform, nitrite of amyl, iodide of ethyl, nitrite of sodium, nitro-glycerin, large doses of chloral, or hypodermic injections of morphia, the latter being generally rated as the most certain means of relief. Coffee is by some considered preferable as a stimulant when such is required.

In order to determine the value of a treatment it is necessary to begin such before the disease is fully established, and especially before the abuse of sedative drugs. A wide range of medicines must be consulted, as successful treatment cannot be conducted with a few specifics.

The attacks may often be modified by homœopathic remedies, prominently by *ipecac.*, *arsenicum*, *grindelia*, *bryonia*, and *nux vomica*, prescribed according to symptoms.

The *bisulphate of quinine* has repeatedly proven useful in purely neurotic cases. The lower triturations or grain pills, three times daily, have been most used. I practically cured with quinine, *i. e.*, brought about a gradual and finally complete cessation of the paroxysms for six years, or until death from apoplexy, a case of twenty years' standing. There were associated with the asthma a highly neurotic stomach and emphysema with weak heart.

Aconite is recommended for fresh cases due to atmospheric causes, even if bronchitic symptoms are present. *Ipecac.* is preferable if bronchial secretion has developed. *Lobelia* if the origin of the attack is clearly

in the stomach. *Cuprum* and *hydrocyanic acid* are called for in the purely neurotic cases (Hughes). Jousset has found *sambucus* sufficient in some cases.

Bryonia has been found useful when the patient has stitches in the side, and to this symptom Jousset adds, vomiting. Personally I have used it in young subjects when asthma has been associated with well-marked catarrhal bronchitis.

Remedies for use during the interparoxysmal period should be selected with great care and their administration persisted in. Among the most important of this class are *nux vomica*, *arsenicum*, *kali hyd.*, *sulphur*, and *iodine*.

Gold causes marked dyspnœa. Its preparations should therefore be studied carefully. *Chloride of gold and sodium*, second decimal dilution, is efficacious in some cases occurring in highly neurotic individuals who complain of many subjective symptoms. The *iodide of gold* has also given some good results, but its sphere is not yet defined.

Recent experiences with the *arsenite of copper* have convinced me that it is a remedy of exceptional value in the ordinary type of bronchial asthma. One case of about eight years' standing was promptly relieved and all symptoms disappeared within a few weeks. The patient was a neurotic woman thirty-five years of age. The oppression was constant, but subject to occasional severe aggravations for a few weeks.

Torstensson, in his interesting report of four hundred cases of asthma to the Fifth Swedish Congress, states that he found in every case swelling of the superior, and often of the inferior, turbinated bodies. For the removal of pressure and irritation he employed chromic acid applied with probes provided with hollow balls at the end. Superfluous acid was removed with cotton and the nose plugged for some hours. Between the cauterizations antiseptic sprays were employed. Cures frequently followed upon five or six applications. In some cases a course of "hardening" of the skin by means of baths proved helpful.

Galvanism may be useful as a part of an interparoxysmal treatment. There should be daily applications for fifteen minutes, of a current as strong as the patient can comfortably bear. According to my own method one electrode should be three or four inches wide and long enough to surround the chest, the other should be applied to the lines of the pneumogastric nerves in the neck and to the upper spine. The former should be occasionally shifted from the level of the epigastrium upward.

To check violent attacks, Dieulafoy recommends a solution of *cocaine* (1 to 20) applied to the nasal fossæ at the beginning of the attack. He prefers moistened cotton, placed as far back as possible. If this is unsuccessful the patient is to breathe freely six to twelve drops of *pyridin* from a handkerchief. As a last resort morphine may be given hypodermatically.

DISEASES OF THE LUNGS.

BRONCHO-PNEUMONIA.

Synonyms.—Acute catarrhal pneumonia; lobular pneumonia.

Definition.—A bilateral inflammation, attacking the lobules of the lungs, being a secondary process following bronchitis of the smaller tubes, the exciting agent entering and being diffused by the bronchi.

Etiology.—Broncho-pneumonia is probably almost invariably consecutive to bronchial inflammation or obstruction, generally both, as inflammation of the smaller bronchi is usually attended by marked evidences of obstruction. The alveoli are involved through extension of the inflammatory process from the bronchi by continuity of surface, or as the result of the irritating influence of inhaled secretion, or it may supervene in atalectatic lung tissue. In but a minimum of cases is the alveolar change developed at the same time and as the result of the action of the irritant causing the bronchitis. Age is a most important element in the etiology, the great majority of cases occurring in infants and those advanced in life, more particularly in the latter when the constitution has been undermined by disease. Not infrequently it is an accompaniment or sequence of many of the specific infectious diseases, especially of measles, smallpox, pertussis, influenza, diphtheria, whooping cough, etc. Any of the predisposing causes of bronchitis favor broncho-pneumonia, particularly anti-hygienic conditions, improper nourishment, the debilitated state following upon many diseases, and a long-retained recumbent position. Irritants of various sorts taken into the bronchial tubes by aspiration may excite broncho-pneumonia, *e. g.*, fine particles of steel or stone, secretions from the upper air-passages, and various micro-organisms, notably, the tubercle bacillus.

Pathology and Morbid Anatomy.—The morbid changes in broncho-pneumonia are found to be confined to groups of air cells (lobules), scattered, as a rule, through both lungs; but, in consequence of the involvement of adjacent lobules, considerable tracts of lung tissue may become consolidated, even to the extent of an entire lobe. These consolidated tracts appear to the naked eye as nodules of various sizes, varying in color from a light red to a bluish where large tracts of tissue are involved. They may become pale (bloodless), firm, and dry, and resemble the lung of pneumonitis in the stage of purulent infiltration. The nodules are friable, and if cut or pressed exude a reddish fluid, or

perhaps a small quantity of dark blood. The points or tracts of consolidation are each surrounded to a varying extent by congestion, œdema, and emphysema, the two former conditions especially being marked when the pneumonic attack has been of considerable intensity. The bronchial alterations are, in the main, those described in the article on bronchitis. Bronchiectasis is common, a dilated tube being often found in the centre of a nodule. The secretion is found to fill many of the smaller tubes, being purulent in character, and frequently tenacious, due to its rich cellular character. At times the secretion is inspissated. Microscopical examination of the lung in broncho-pneumonia shows the process to be one of catarrhal inflammation, the predominant elements being epithelial cells with well-marked nuclei. In broncho-pneumonia, as in pneumonic fever, we distinguish three stages in the pathological process, although, in the former disease, they are not so clearly defined as in the latter. The first stage is characterized by vascular engorgement. The air-vesicles contain fluid, serous or purulent in character, or both. Blood corpuscles in considerable numbers may be present. The alveolar epithelium is swollen and granular, and desquamation is in progress, free cells existing in the fluid exudate. According to Rindfleisch and others, there is an active proliferation of the epithelium. In some cases, this desquamation progresses to its full extent (developing the second stage) without any great amount of the liquid exudate preceding or accompanying it. The second stage is one of complete consolidation, the alveoli being packed with the desquamated epithelium, pus cells and a few red blood corpuscles. Contrary to the assertions of many writers, the author has found a small amount of fibrillated fibrin, particularly in cases running a rapid course after measles. The third stage differs in character according to the course of the disease. If favorable, the cellular contents undergo fatty degeneration, transformation and absorption, or expectoration, with a final restoration of the alveolar epithelium. In a word, resolution occurs. If unfavorable, cheesy degeneration, interstitial pneumonia, abscess, gangrene, etc., may result. Pleurisy is a not infrequent complication, occurring especially in cases in which the nodules are near to the surface of the lung, the pleura over such points being covered with a layer of lymph. According to Jürgensen (corroborated by Fagge), the inflammatory process occasionally spreads to the connective tissue uniting the lobules, leading to the development of grayish bands, which can be seen intersecting each other on the cut surface of the organ. Atelectasis is commonly associated with broncho-pneumonia in children. The lesions of broncho-pneumonia not infrequently become tuberculous.

Symptoms.—The symptomatology of acute broncho-pneumonia varies considerably in different cases, and the variation is governed especially by its intensity and duration. The early symptoms of the

average attack are essentially such as are found and already described in speaking of bronchitis affecting the smaller tubes. This is readily understood in view of the statement already made that the inflammatory process in the parenchyma of the lung is invariably secondary to a capillary bronchitis. It is difficult to determine either by signs or symptoms the early stage of lung involvement, but extension to the parenchyma may be suspected if, during the course of a bronchitis, there should occur a sudden elevation of temperature, attended by increased rapidity of respiration, the respirations ranging all the way from 50 to 80 per minute. The respiratory efforts are labored. Unlike pneumonic fever a chill rarely ushers in the disease, and the rise of temperature is gradual, reaching 103° to 105° F. or more. The range not being typical, exacerbations and remissions occur irregularly. The pulse is rapid, particularly in the young, ranging from 140 to 160, it early loses force and becomes readily compressible. The loose cough of the preceding bronchitis becomes dry and hacking, and the coughing efforts are attended by pain, usually felt under the sternum, although it may be confined to the sides and be due to a co-existing pleurisy. Expectoration is often slight or absent in the young, and is muco-purulent, rich in cell elements, may be blood-streaked, or contain small quantities of blood indifferently mixed with the ejected matters. The rusty appearance of the sputa, so characteristic of the croupous form of pneumonia, is never present. In cases tending towards a fatal termination the most prominent symptoms are those connected with the respiratory function. The respirations are increased in frequency, the inspiratory efforts becoming feeble and short, the extraordinary muscles of respiration are brought freely into play, and there are alternate expansion and contraction of the alæ nasi. Failure of the heart manifests itself at this stage of the disease, shown by the impairment of the force of the systole and consequent feeble pulse, cool perhaps clammy extremities, and cyanosis. In cases tending healthward there is a decrease in the number and of the effort attending respiration, lowering of the temperature and increasing strength of pulse.

Between the acute and chronic forms of the disease there exist all degrees of intensity, but usually when chronic the progress is slow and the intensity slight. The elevation of temperature is usually not great, but it rises slowly to its acme, seldom reaching above 102° F. The fever fluctuations are, however, as irregular as in the acute form. Both the pulse and respirations are increased in frequency, and dyspnœa, loss of appetite and general failure in strength and flesh occur. The tendency in unfavorable cases is to systemic and heart failure, rather than to special failure of the respiratory apparatus, as in acute attacks. Where respiratory breakdown does occur, it is due to progressive loss of power in the muscles of respiration.

Physical Signs.—Percussion shows isolated points of consolida-

tion. Vocal fremitus is increased over the involved areas. Auscultation reveals small mucus râles, heard during inspiration and expiration, and having a metallic character (the consonating râles of Skoda). If absent, these râles may be developed by inducing the patient to cough. When present they indicate pulmonary consolidation.

Complications and Sequelæ.—Bronchitis has been mentioned as a feature of all cases. Pleurisy probably occurs oftener than has been generally supposed, particularly where the lung involvement has been extensive. Liquid effusion is rare. Pneumonic fever and simple capillary bronchitis occasionally supervene. Intestinal catarrh is a serious and frequent accompaniment in young children and infants. Convulsions may occur at any stage and are of evil omen. The cerebral symptoms sometimes simulate meningitis.

Diagnosis.—The diagnosis of broncho-pneumonia in the early stage of active cases, as well as during the entire course of those of a slight intensity, is often difficult or impossible. This difficulty will be readily comprehended if the reader will recall the fact that the inflammatory process is at first limited to scattered lobules surrounded by lung tissue pervious to air. Such small areas of consolidation, unless in considerable numbers or in near relation to each other, do not give rise to dulness on percussion, and therefore there is an absence of one of the most reliable signs. For the same reason bronchial or broncho-vesicular breathing is seldom marked. The physical signs are those peculiar to bronchitis, to which are added those indicative of consolidation of limited areas of lung tissue, which rarely indeed involves a whole lobe. The crepitant râle is looked upon by some observers as diagnostic of broncho-pneumonia. However, it is seldom detectable, probably being obscured by the moist râles in the finer bronchial tubes. If during the course of a simple bronchitis limited consolidation can be detected, indicated by bronchial or broncho-vesicular respiration and dulness on percussion, we have the positive signs of the existence of a broncho-pneumonia. It is at times difficult to distinguish between broncho-pneumonia and the various forms of bronchitis, especially the capillary form, also between broncho-pneumonia and pneumonic fever or phthisis. In children the differentiation from pneumonic fever is exceedingly difficult on account of the inability to determine moderate degrees of consolidation, or, if such is discovered, to decide whether it is due to collapse of lung tissue, lobular or lobar consolidation. The bilateral development of the lesion in broncho-pneumonia is a diagnostic feature of first importance. In adults, however, the history of the mode of invasion and the fact that the consolidation occupies an entire lobe in pneumonic fever, make the distinction usually an easy one. In simple capillary bronchitis the fever is moderate, the prostration marked, and there are defective aeration of blood and absence of areas of consolidation. The clinical history and physical

signs so closely resemble those of some rapid cases of phthisis that the discovery of the bacillus tuberculosis in the sputum must be relied upon for an early opinion.

Prognosis.—The prognosis is very largely affected by the conditions present at the time of the development of the broncho-pneumonia, the younger, the older, or the feebler the patient the greater the probability of a fatal issue. If the nutritive state is impaired, if the surroundings are unhygienic, if rachitis, heart disease, Bright's disease or diabetes is present, the outlook is unfavorable. The prognosis is less favorable when broncho-pneumonia complicates whooping cough than when it complicates measles. The prognosis is immediately affected by the intensity of the existing bronchitis, the extent of the consolidation and the height of the temperature. When the fever reaches 105° F., it is of grave portent. The mortality in young children is estimated (the estimate being based upon allopathic records) at 20 per cent. Under homœopathic treatment the loss is certainly less than 10 per cent. The duration of the disease is from ten days to three weeks, the acute symptoms usually subsiding in two weeks. Death results from prostration in protracted cases, from asphyxia when the bronchitic symptoms are very prominent, or from a variety of complications. The ultimate prognosis in cases in which complete resolution has not occurred is not favorable, many such going on to phthisis, for while broncho-pneumonia is believed to result in resolution in the majority of cases that recover from acute attacks, such resolution is incomplete, and these incompletely resolved points form foci for the development and extension of chronic catarrhal pneumonia and its consequences.

Treatment.—Broncho-pneumonia is almost constantly attended by general enfeeblement of the system. This fact can be appreciated if it be remembered that the disease is secondary to troubles in themselves exhausting, and in constitutional states tending towards asthenia. There exists an active inflammation, and this fact should never be forgotten in the treatment. The existence of an active inflammation in an enfeebled constitution indicates a supportive treatment and an avoidance of all depressing measures. Thorough quiet should be insisted upon. But while the patient should be kept quiet in bed the decubitus should be changed frequently. This latter procedure is believed to assist in the prevention of lobular collapse. The most nutritious foods, preferably of a fluid character, should be given frequently and in as large quantities as the patient can well appropriate. The body should be sponged frequently, the sick-room be thoroughly ventilated, but the temperature not allowed to fall below 70° F. Prostration is an early symptom, and is manifested mainly by the heart. Therefore the possibility of heart-failure should be anticipated and met by the prompt use of alcohol in some of its forms. Respiratory failure occurs in cases in which the bron-

chitic symptoms are most prominent, and such failure results mainly from the obstruction of the smaller bronchial tubes, but also from the excessive accumulation of secretion leading to collapse of the lobules. When the patient is old enough to follow instructions active inspiratory efforts should be practised. In the young something may be gained by stimulating inspiratory efforts by means of friction of the respiratory muscles, gently kneading the muscular structures of the chest, using vaseline or other unguent. In urgent cases Jürgensen's method of exciting respiratory efforts, by means of a stream of cool water projected on the nuchæ, may be adopted. Emetics under these conditions are of questionable value.

Drugs occupy a prominent position in the treatment of broncho-pneumonia, the progress of the disease being materially shortened and its intensity diminished by their employment. The following will be found especially useful:

The remedy most frequently of value in the first stage of typical cases is *ferrum phosphoricum*. The results that have followed its exhibition are both numerous and brilliant. Its administration is only contra-indicated by marked bronchial obstruction, manifested by dyspnœa, moderate fever, impaired surface circulation, heart feebleness and cyanosis. When these symptoms are present, *tartar emetic* is preferable. Should minute doses of this drug fail to afford relief, it should then be administered in quantities of one one-hundredth of a grain frequently repeated.

Phosphorus is probably given more frequently than any other remedy by the majority of practitioners, and it is certainly an occasionally valuable medicine. It is more suitable, however, to broncho-pneumonia occurring in degenerate adults, those suffering from fatty degenerations, Bright's disease, diabetes, pulmonary phthisis, etc. The febrile symptoms are less marked than those indicating ferrum phos.

Bryonia is particularly suitable to cases complicated with pleurisy, which is not common. When the symptoms of capillary involvement are not prominent, and there is much complaint of pain and soreness in the substernal region when coughing, children being inclined to hold the chest while coughing, bryonia gives good results.

The indications for *squilla* are nearly identical with those calling for bryonia. It is often given if bryonia fails, or after that medicine has done its work. There is more irritability of the mucous membranes and more spasmodicity in squilla than in bryonia.

Sulphur is useful after any of the preceding medicines, and is the better indicated the more the pulmonary consolidation predominates over bronchitic or pleuritic symptoms.

Aconite or *gelsemium* may be demanded for the febrile symptoms of the early stage, and the *iodide of antimony* when the bronchial element is

pre-eminent. This medicine is of first importance in the attacks of broncho-pneumonia occurring in the course of some cases of pulmonary phthisis. The *arsenite of antimony* is an important remedy in the broncho-pneumonia of the aged, with loud râles and feeble heart.

Especial care should be exercised during convalescence from broncho-pneumonia to secure perfect resolution of the inflamed lung, as neglected cases are likely to be followed by a phthisical process. The patient should be kept under constant observation until all traces of consolidation have disappeared. In some instances resolution can only be secured by the best hygienic and dietetic measures, together with change of air, cod-liver oil, and respiratory gymnastics. Medicinally, such cases must be treated symptomatically. The therapeutic sections of capillary bronchitis and of pneumonic fever may be consulted with advantage.

ATELECTASIS.

Varieties.—Congenital, acquired, diffuse, and lobular.

Nomenclature.—Apneumatosis; collapse of the lung; lobular collapse.

Definition.—Atelectasis is a collapse of the walls of the pulmonary alveoli, a condition which may be diffused throughout large areas of the lungs, or, as is usually the case, be limited to individual lobules or groups of lobules. The normal condition of the lungs in fœtal life is that of collapse of the alveoli. Congenital atelectasis is the persistence of this fœtal condition.

Etiology.—The non-expansion of the lobules of the lungs after birth is generally the result of defective pulmonary development or insufficient power of chest expansion. The causes of these conditions are generally intra-uterine, but they may arise from premature birth, separation of the placenta, compression of the cord, and protracted labor. During the passage of the child liquor amnii and mucus may be drawn into the bronchioles and produce obstruction of those tubes. Acquired or secondary atelectasis, which was first described by Bailly and Legendre, occurs after respiration has been established, and usually results from bronchial obstruction consequent upon bronchitis and plugs of mucus blocking up the bronchioles. Sometimes they act as valves, permitting the egress, but not the ingress, of air. Thus all the air in the tributary alveoli is expelled, and the walls collapse. In other cases the obstruction is complete, and the alveoli are emptied of the contained air by absorption. Especially is this condition liable to occur in bronchitis secondary to whooping cough and measles. The pulmonary collapse is rendered all the more possible in these cases by weakness of the inspiratory muscles, and by all causes which tend to constitutional deterioration of the patient. Atelectasis is particularly liable to attend bronchitis developing in patients enfeebled by rachitis, chronic wasting diseases, and by bad

hygiene. It may also arise from direct pressure upon a bronchus or the vesicular structure of the lung, as by an aneurismal growth, enlarged bronchial glands, or other intra-thoracic tumor. Pressure on the vesicular structure alone is generally the result of fluid in the serous cavities.

Pathology and Morbid Anatomy.—An examination of an atelectatic lung shows that certain of the lobules are depressed below the general surface, and are darker in color than the normal, varying in color from a reddish to bluish or grayish. If divided and carefully examined these lobules will be found denser, drier, and tougher than the normal lung, and fail to crepitate when pressed upon. The changes just noted are found in young infants particularly. In the congenital form the posterior portion of the lower lobes is most affected. When of the acquired variety the affected lobules are more generally diffused throughout the lungs. Upon microscopical examination the alveoli are found in a partially or completely collapsed condition. They contain a certain amount of secretion, probably inhaled from the bronchial tubes. The tissues adjacent to the collapsed lobules are congested and œdematous.

Symptoms.—The acquired form is preceded by the ordinary symptoms of capillary bronchitis, the occurrence of atelectasis being characterized by increased difficulty in breathing, and usually by higher temperature and more marked constitutional symptoms. If, however, the atelectasis invades extensive areas of lung tissue, the temperature may be depressed, and excessive dyspnœa attended by cyanosis and prostration be developed. In the congenital form the symptoms will depend very largely upon the extent of lung involvement. Fever is absent or less marked than in the acquired form, and the symptoms are especially those which relate to the obstructed respiration. The breathing is increased in frequency and difficulty in direct proportion to the amount of lobular collapse.

The character of the physical signs will depend very much upon the extent of the atelectasis. Upon inspection of the chest in the congenital form, there may be observed in well-pronounced cases a retraction of the inferior ribs and intercostal spaces, the result of non-expansion of the lungs. Percussion shows dulness over the collapsed area. Such areas may be so small, so scattered and imbedded in normal lung tissue, as to fail to affect the normal percussion note. Auscultation usually reveals the râles of capillary bronchitis, broncho-vesicular respiration, or even absence of respiratory sounds if considerable areas of pulmonary tissue are involved.

Diagnosis.—High degrees of atelectasis are easily distinguished. Slight degrees are very difficult to determine. If in the course of a bronchitis there is a sudden elevation of temperature, increased respiration, dulness on percussion over limited areas, with feebleness or absence of the respiratory murmur, a diagnosis of atelectasis can safely be made.

When this condition affects single or small and widely scattered groups of lobules, it is almost impossible to recognize its existence.

Atelectasis is frequently mistaken for pneumonia, especially of the lobular type. A differentiation is not always possible; indeed the conditions are often associated. If a newly-born infant makes rapid superficial efforts at respiration, exhibits shortness of breath while nursing, and has a weak voice and blueness of the skin, a diagnosis of atelectasis may be made. This state can hardly be confounded with any other condition than bronchitis. The latter may be excluded if there is an absence of râles and cough. The dependence of such symptoms upon heart malformation must be eliminated by physical examination.

Prognosis.—High degrees of atelectasis are usually fatal. It is claimed that one-fourth of the deaths in infancy are the result of this condition. The most dangerous of the acquired cases are those following whooping cough and measles.

Treatment.—The indications for the management of the acquired form are first, measures directed to the subjugation of the primary disease; and secondly, the stimulation to expansion of the collapsed lung, which is attempted by means of such measures as massage, douches, electricity, etc. Especial attention should be paid to the nourishment of the patient.

The congenital form should be treated by the application of one of the forms of artificial respiration. More vigorous respiratory acts should be excited by the cold douche, flagellation, etc. The child should be encouraged to cry. If these measures fail, the lungs may be inflated by the attendant applying the mouth to that of the child, and while holding its nose blowing air in. All mucus should be carefully removed from the mouth and nose, and, if examination shows a considerable accumulation in the bronchial tubes, an emetic may prove of great value.

Drugs effect but little in the congenital form, but are of decided value in atelectasis consequent upon bronchitis. The indications for remedies are such as are developed mainly by the co-existing and causative disease. Of remedies most likely to be of value *antimonium tartaricum*, as well as the *arsenite of antimony*, *lachesis* and *sambucus*, may be mentioned. For further indications reference must be made to the sections upon capillary bronchitis and broncho-pneumonia.

EMPHYSEMA.

Synonyms.—Vesicular emphysema; surgical emphysema; alveolar ectasis.

Definition.—The term emphysema has been applied to two separate conditions; properly to extravasations of air especially into the subcutaneous connective tissue and the interstitial tissue of the lungs, and improperly to the degenerative changes in the framework of the

lungs resulting in overdistention and rupture of the alveoli. The former is designated *interlobular emphysema*, and the latter *vesicular emphysema*. The recently adopted term *alveolar ectasis* is a more appropriate designation for the latter variety.

Vesicular emphysema is manifested in several varieties. There is an *acute form* which occurs during the course of acute diseases of the lungs and bronchi, and in which the air vesicles had been normal in structure prior to the onset of the illness. This variety of emphysema gives rise to no special symptoms of its own, and as a rule subsides promptly after recovery from the primary lesions. It may occur in persons of any age. A *compensatory emphysema* has been recognized. In this variety certain air vesicles dilate owing to obliteration or destruction of the same structures in other portions of the lungs. Such a condition must be regarded as a conservative process and as beneficial to the patient. Lastly, we have a form of emphysema which is the one usually described in the books as a substantive affection, and hence may be spoken of as *substantive emphysema*. It is characterized by dilatation of the air cells, atrophy of their walls and destruction of their capillaries.

Interlobular emphysema arises from violent coughing, excessive exertion as in straining at stool or during parturition, and from injuries. The air vesicles are ruptured and air thus escapes into the neighboring connective tissues. There are no distinctive symptoms produced by it other than the external evidences of the presence of air in the subcutaneous structures about the neck and thorax. It is a serious condition in many instances.

Etiology and Pathology.—The most important feature of vesicular emphysema is a loss of elasticity in the lung tissues, resulting in imperfect power of contraction. This is readily shown at the autopsy by the failure of the exposed lung to collapse on the opening of the chest wall; indeed there may even be the opposite condition, the overdistended lung protruding from the parietal opening.

The results of an examination into the causes of emphysema indicate that it is due to strain of the pulmonary tissues and probably also to an inherited or acquired weakness of the framework of the lungs. Of the exciting causes of this disease much has been written; of the predisposing conditions but little. The lungs of the aged undergo changes which predispose their owners to emphysema, their elasticity being impaired through long use. Strümpell aptly compares the lungs of the old to a rubber band, which from long use stretches and becomes less elastic. The pulmonary tissues of individuals in middle life, however, cannot be expected to undergo such changes unless the lung tissue loses much of its normal powers of resistance, or unless the organs are exposed to an unusual degree of strain. The occurrence of vesicular emphysema in persons still free from changes due to age, and in persons who have

not been subjected to the well-known causes of this disease, strongly suggests that some persons may possess lung tissues more vulnerable than those of others. Hereditary weakness of the lung structure has been suggested as a predisposing cause, an idea that has received the confirmation of statistics, and which has been strengthened by the fact that young children are occasionally seen who give some evidence of the "emphysematous habit" and even some degree of pulmonary rarefaction. As to which tissue element is defective in quality or quantity in emphysema we are yet only able to surmise. A discussion of the predisposing causes of the pulmonary weakness is a matter of great importance, for it is only by their discovery that we can hope to cope satisfactorily with this disease. Rainey believed that the vesicular walls underwent a fatty degeneration, basing his views, however, on the investigation of but one case. Jenner taught that the essential lesion was a fibroid degeneration. While these changes undoubtedly exist in many cases, they cannot be of universal application. At present we can only say that some weakness, the result of perverted local nutrition, exists. It may even be that this malnutrition gives no macroscopic or microscopic evidence of its presence under existing methods of investigation, and must therefore be attributed to loss of tone in the walls of the air vesicles.

The exciting causes are all to be included in influences which increase the intra-vesicular air pressure, in other words, lung strain. This is observed in the case of persons following certain occupations, such as glassblowers and performers on wind-instruments, also in persons whose labors involve great muscular strain.

The relationship of micro-organisms to emphysema has been studied in twenty-four cases by Prudden, who discovered bacteria in the exudate of all. The streptococcus pyogenes was most frequently found in simple emphysema (seven out of eight cases). Most cases of metapneumonic emphysema (nine of eleven cases) were associated with the micrococcus lanceolatus. A variety of bacteria, mostly bacilli, were found in four cases. The staphylococcus pyogenes aureus was met only once.

It is not surprising that emphysema should be a common sequence of bronchitis and asthma. The severe cough of the former and the obstruction to expiration in the latter are sufficient to develop this affection if either of these primary diseases is sufficiently prolonged.

Both sides are generally affected in typical cases, but the degenerative changes are not evenly distributed throughout the organs.

Sir William Jenner especially has called attention to the higher degree of the development of emphysema in the anterior and lower portion of the lungs, as well as its development about old cicatrices near the apices of the lungs, which he ascribed to the fact that these parts have less support from the surrounding structures, consequently are more readily distended by the air pressure within.

Freund has attempted to establish a primary rigid dilatation of the thorax as a cause of emphysema, but has not gained much support in advocacy of this doctrine, most authors regarding the parietal changes as secondary. Rindfleisch has pointed out that the primary changes occur in the central infundibular cavities, the dilatation of the alveoli occurring later. After degeneration and rupture of the alveolar walls, remnants of the latter mark their former sites. If the disease develops from frequently repeated catarrhs of the bronchi, the lung structure is toughened by the newly formed tissue, which still further lessens the pulmonary elasticity.

Post-mortem examinations and the use of the microscope show the air spaces greatly dilated, the extent of the dilatations varying much in different cases and in different parts of the lungs in the same case. Perforations are observed in the walls of the air vesicles, and the capillaries are enlarged and lessened in number. The surrounding connective tissue is thickened, as is also the bronchial mucous membrane.

The changes secondary to emphysema are quite constant and important. The chest enlarges in all directions, assuming the peculiar barrel shape. The work of the right heart is increased owing to the obstruction in the pulmonary circulation resulting from destruction of capillaries and the pressure exerted upon these vessels by the dilated lung structure. This organ, therefore, hypertrophies, and later, undergoes dilatation. Tricuspid insufficiency may result, with ultimately engorgement of the venous system, hyperæmia of the liver, kidneys and the abdominal organs generally. Albuminuria and dropsy of the lower extremities sometimes occurs.

Symptoms and Course.—The great majority of cases of emphysema develop during middle and advanced life. A few cases are observed in children. While shortness of breath may be the first phenomenon to attract attention, it is usually the symptoms of the attending bronchitis which the physician is first called upon to treat. So closely associated with bronchitis is this affection that imperfect observation may lead to the overlooking of the true nature of the disease until it has well advanced. The associated circulatory lesions likewise tend to obscure a diagnosis. The bronchitic symptoms are of an ordinary character, *i. e.*, cough, expectoration, slight dyspnœa and constriction of the chest. The development of bronchiectasis not infrequently adds to the intensity of these symptoms. Dyspnœa especially becomes prominent. Observation must soon convince the attendant that the degree of dyspnœa is too great to be accounted for by a simple bronchitis. The patient experiences an increasing difficulty in rapid walking, running and ascending stairs. After a time dyspnœa becomes continuous, but subject to occasional exacerbations. Orthopnœa is common at night in advanced cases. All of the extraordinary muscles of respiration are brought into use.

The neck muscles (sterno-mastoids and scaleni) are prominent with each inspiration, the clavicles are elevated, and every effort is made to augment the tidal air. Expiration is slow, wheezy and difficult, and the abdominal muscles are strongly contracted during the act. Attacks of spasmodic asthma complicate some cases. The dyspnœa is by no means proportionate to the amount of vesicular dilatation. It may be increased by spasm of the bronchial tubes, by increased tension of the systemic circulation, and by increased intra-pulmonary tension. In any individual case it is difficult to apportion the extent to which each of these factors bring about the dyspnœa.

With well-developed emphysema symptoms resulting from obstruction to the circulation appear, the vessels of the face and neck are turgid, the capillary circulation in the extremities is feeble, and vertigo due to retarded cerebral circulation is especially apt to occur after exertion. There may be hæmoptysis, sluggish digestion, much flatulency, gastric catarrh, hæmorrhoids and rectal hæmorrhage, all due to circulatory obstruction.

Some cases exist without pulmonary symptoms, and are characterized by progressive emaciation and loss of strength, paroxysms of arterial contraction and a host of symptoms resulting therefrom.

The clinical course of emphysema is that of a slowly progressive affection usually requiring years to reach the stage of characteristic development. In rare cases the progress is rapid, marked changes and symptoms developing within a few months. Progress is accelerated by the occasional attacks of acute bronchitis. Death may occur from severe intercurrent bronchitis, pneumonia, or more gradually as the result of cardiac dilatation. Overdistention of the heart with cyanosis and the general symptoms of failing circulation may occur, especially during attacks of severe bronchitis or pneumonia. Dangerous and fatal hæmorrhages have been reported.

Physical Examination.—Inspection. The appearance of the patient suffering from emphysema is quite suggestive of the nature of the affection. The chest is enlarged and "barrel-shaped." The ribs and sternum are elevated, causing the neck to appear shortened. Attention has been directed to the presence of a line of dilated veins corresponding to the line of attachment of the diaphragm. This is not peculiar to emphysema, however. Inspiration is short and distends the chest but little. It seems rather to elevate. Expiration is prolonged, labored and wheezy. During inspiration the upper portions of the chest and abdomen may be retracted. During coughing efforts a distention of the supraclavicular regions may occur, caused by the inflation of the apices of the lungs, and also partly to distention of the jugular vein and sinus. This swelling has been termed the emphysematous tumor. Mensuration demonstrates marked increase in the antero-posterior diameter of the

chest. Inspection of the posterior surface reveals a marked increase in the curve of the spine and a change in position of the scapulæ, which approximate toward a horizontal position.

Palpation. Vocal fremitus is diminished. The apical impulse is feeble or absent, and impulse may often be felt and seen in the epigastrium.

Percussion. Resonance is increased in proportion to the extent of the emphysema. It is occasionally tympanitic. The areas of cardiac and hepatic dulness are partially or entirely obliterated. The line of splenic dulness may also be found at a lower level.

Auscultation. The respiratory sounds are usually enfeebled, although inspiration is sometimes exaggerated. The most important auscultatory sign is prolongation of the expiratory sounds. In typical cases there is a reversal of the relative duration of the in- and expiratory sounds, expiration being three or four times the length of inspiration. Expiration is often harsh and wheezy, and accompanied by both coarse and fine râles. Flint called attention to the low pitch of the expiration sound in emphysema.

The heart sounds are very indistinct, with the exception of the pulmonary second sound, which is often normal or even accentuated. They may be often heard very clearly in the epigastrium. In advanced cases when dilatation of the right ventricle has taken place, a tricuspid regurgitant murmur may develop.

In the interlobular variety, physical diagnosis reveals the same character of morbid alterations found in the vesicular form. DaCosta states that "a dry friction sound and a large dry crackling, both of which occur occasionally in vesicular emphysema, are much more common in the interlobular variety." It is sometimes detected by extension to the subcutaneous tissues, especially of the neck, giving rise to crackling upon pressure.

Prognosis.—The emphysematous change is not in itself fraught with danger, but rather the accompanying and sequential troubles. The close association with bronchitis which exists makes it necessary to consider the latter affection in prognosticating. Death may result from a complication at any period of the disease. Bronchitis, catarrhal or croupous pneumonia, sudden cardiac weakness, and even asthmatic attacks, have all led to fatal results. With the development of extensive heart changes, death appears to be only waiting for some of the consequences of obstruction of the circulation to develop in order to claim the victim.

Treatment.—Emphysema is an incurable affection, *i. e.*, any degree of degeneration of the alveolar walls already present is permanent, but much can be accomplished in the direction of arrest of the morbid process. As a class, these patients are grossly neglected. Careful attention

to the selection of a proper diet for the individual and the correction of digestive disorders which may exist are of first importance. Early, the food should be of a most nourishing kind and rich in nitrogen; later, with a weak digestion, weak heart and feeble excretory organs, restriction must be practised. A milk diet is often valuable at this period, but best in the form of koumiss or peptonized milk. Starches and sugars must be avoided. Alcohol is decidedly objectionable. Tobacco in any form is not permissible.

Outdoor exercise should be insisted upon even if a change of climate is required to accomplish it. Tire, and particularly exhaustion, must be rigidly avoided. Everything tending to exaggeration of the respiratory efforts must be shunned. Protection from cold and damp must be accomplished in every manner possible. Existing cough should be kept at the minimum, and attacks of acute bronchitis treated promptly.

Inhalations of oxygen and compressed air are strongly recommended. For the selection of medicines the reader is referred to the sections on bronchitis, asthma, and the various chronic affections of the heart and circulation. There are no medicines known to be of value for emphysema *per se.* Those acting upon the connective tissues and degenerative processes generally are the ones to be considered. *Calcarea carb.*, *calcarea phos.* and *calcarea fluorica*, *fluoric acid*, *lycopodium*, *silicea*, *sulphur*, *ferrum phos.*, *phosphorus*, *aurum mur.*, and *kali hydriodicum*, are perhaps the most important. The calcareas are best suited to corpulent persons who sweat easily, and must be differentiated by individual symptoms; *e. g.*, calcarea carb. is better suited to women who menstruate copiously, and calcarea phos. to old men who have arterial degeneration, arcus senilis, etc. Phosphorus is useful in the same class. Lycopodium benefits flatulent dyspeptics who are gouty, and the latter condition suggests also kali hydriodicum. When arterio-capillary fibrosis is a prominent feature the chloride of gold may sometimes be prescribed with advantage. It is called for when the patient is nervous and has a low gravity urine.

For the asthma, consider *arsenicum*, *arsenite of antimony*, *arsenite of copper*, *grindelia robusta*, *lobelia inflata*, *ipecacuanha.* When the asthma is associated with high arterial tension, *glonoin* 2x, is often of service, also *iodide of strontium*, *nitrite of amyl* or *nitrite of sodium.* As a palliative during the paroxysms, inhalations of chloroform, of the smoke from stramonium leaves or nitre paper are much employed.

For the gastric disturbances, *argentum nitricum*, *carbo veg.*, and *lycopodium* are particularly valuable.

Arsenite of antimony, *kali carb.*, *kali bichr.*, *ipecacuanha*, and *antimonium tart.*, are often indicated. The first-mentioned has proven more valuable than any medicine I have prescribed.

For the enfeebled heart, *sulphate of sparteine* 1x, *agaricine* 1x, *strychnia* 2x, and *arsenic* 2x have given the best results. In the late stages, digitalis often improves the patient for a time.

PULMONARY CARCINOMA.

Varieties.—Carcinoma of the lung may be either primary or secondary. All of the different varieties of this malignant growth have been found in the lungs.

Etiology.—The etiology of carcinoma attacking the pulmonary parenchyma does not differ from that of carcinoma in any other locality. Infrequent as is this development, it occurs at all periods of life excepting perhaps in the very young. Heredity is a powerful causative factor. The majority of cases are secondary to cancer of the female breast, although carcinoma of the lung may be secondary to a similar malignant growth occurring originally in any portion of the body. Primary cancer of the lung is very rare. It appears to take its origin from the epithelium of the bronchial mucous membrane, particularly from the glandular cells. Statistics of primary carcinoma collected from different sources indicate that in the large proportion of cases, one lung only is involved. Secondary cancers of the lung are of late development. They are found rather more frequently in the right lung, and in the upper portion of that organ, although Risdon Bennett's cases are opposed to this statement.

Morbid Anatomy.—The medullary or encephaloid forms of cancer are most frequently met with, scirrhus being much less often found. Epithelioma and the melanotic variety are observed still less frequently. Cancer of the lung develops in the form of multiple tumors. They do not attain a large size when secondary, as they usually are, as they develop when the system is considerably depreciated by the primary affection. Death therefore occurs from exhaustion before extensive pulmonary infiltration can take place. Usually the disease begins simultaneously at several points, small nodules being formed at these several foci. The nodule gradually enlarges by peripheral invasion of the normal lung structure. As the result of this gradual growth or of the coalescing of several primary nodules, a considerable portion of a lobe or of the entire organ may become consolidated. The bronchial glands and pleuræ are usually involved, the glands frequently being much enlarged and the pleural membrane studded with small nodules. The latter condition may even obtain when the parenchyma of the lung is only slightly involved. Pleural effusion usually occurs, and pleuritis itself is not uncommon. Secondary changes occur in the nodules in the form of softening and liquefaction, resulting in the formation of cavities. A secondary inflammation is also set up in the periphery of the nodules.

Microscopic Appearance. Upon examination of properly pre-

pared sections of carcinomatous lung two facts are noted. The first is, that the alveolar walls are in the main preserved; secondly, that the alveoli are packed with large cells containing large nucleolated nuclei, usually spherical, and at times polygonal in shape. Therefore, according to Cornil and Ranvier, the stroma of the neoplasm consists of thickened and altered alveolar walls.

Symptoms.—There are no characteristic symptoms of carcinoma of the lungs; those produced by and accompanying it being more or less common to other pulmonary affections. The local symptoms are usually few and of slight intensity, consisting of cough, expectoration, and pain, the latter varying in character and location. The general symptoms are those of cancer elsewhere.

Physical Signs.—These are such as attend consolidation of pulmonary tissue from any cause, and of coexisting limited bronchitis and pleurisy.

Diagnosis.—The history is of pre-eminent importance in making a diagnosis. If, in connection with cancerous disease of some portion of the organism, signs of consolidation of the lungs are developed, perhaps associated with circumscribed bronchial râles or a limited pleurisy, it is safe to diagnosticate pulmonary cancer. If the carcinomatous infiltration goes on to the extent of producing compression of important structures, the signs indicating such compression are added. Compression of the trachea or recurrent laryngeal nerve may lead to dyspnœa and aphonia respectively. Pressure upon the pulmonary veins would cause congestion and œdema of the lungs and bronchial hæmorrhage. Difficult ingestion of food may be induced by pressure upon the œsophagus. The heart may be displaced.

Termination.—Death is the invariable termination.

Treatment.—The indications for treatment are, first, to improve the nutrition of the patient by careful attention to diet, hygiene, rest, and exercise; and, secondly, to retard the progress of the development of the growth and relieve especially troublesome symptoms. The medicines of most value are such as have been suggested for cancer in general. Reference may also be made to the sections upon bronchitis, phthisis, pleurisy, etc., for indications for the treatment of groups of symptoms.

PULMONARY GANGRENE.

Definition.—Death of lung tissue. This may be either circumscribed or diffuse.

Etiology.—Before the exciting causes of pulmonary gangrene can become operative, it is necessary in most cases that certain predisposing factors be present. These are found in all agencies which tend to constitutional depreciation. Persons who have long been the subjects of malnutrition growing out of such chronic ailments as Bright's disease

and diabetes, habitual intoxication, dissipations of all sorts; the poorer classes, *i. e.*, those who are illy fed, badly clothed, and exposed to the vicissitudes of wet and cold, form the class of patients in whom it is possible for pulmonary gangrene to occur. Infection of the lung tissue by a specific bacterium is now generally regarded as a frequent exciting cause. By Strümpell it is looked upon as the only one, for he says: "The entrance of the bacteria of putrefaction is the sole cause." Still the above-mentioned predisposing causes must be present, for the healthy organism is able to resist the infection.

Pneumonia, especially lobar pneumonia, bronchiectasis and phthisis with the formation of cavities, are liable to develop local gangrene, the last two mentioned by infection with their putrid secretions. Pulmonary embolism has caused the disease in some instances. It may do so either by the mechanical effect of the embolus, or by the introduction of an infecting foreign body into the pulmonary circulation. In the former instance, the tissues supplied by the obstructed vessel simply die from lack of nutrition. In the latter the plug probably originates from destructive and infectious processes elsewhere, as gangrenous bedsores, puerperal inflammations, suppurative caries, etc. Sloughing does not necessarily ensue from the mechanical effects of an aseptic embolus. Foreign bodies are probably a more frequent cause of gangrene of the lungs than is ordinary held. Instances have been recorded in which the existence of this cause was only revealed at the autopsy. Especially are foreign bodies of an organic nature active in this respect, capable as they are themselves of undergoing putrefaction. Patients suffering from organic nervous diseases, insanities, and paralyses of the muscles of deglutition, are very liable to get food into the respiratory passages.

Certain severe ulcerations of the mouth, pharynx, larynx, or trachea, are liable to cause gangrene of the lungs by aspiration of their infectious secretions.

Systemic poisons, as those of typhus, smallpox, measles, glanders, pyæmia, septicæmia, and the venom of animals, may produce gangrene of the lungs.

Cases have been reported as occurring after traumatisms of the chest walls, and that, too, without any external lesion, either of the skin or ribs.

Pathology and Morbid Anatomy.—The morbid changes in pulmonary gangrene may involve any portion of the lung, but they are more frequently found in the lower lobes and the superficial structures of the right lung than elsewhere. The changes are not by any means restricted by the anatomical divisions of the lungs, but may involve small areas or an entire organ. In the circumscribed variety, the necrotic tissue usually ranges in size from one-third of an inch to an inch and a half in diameter, although any size not larger than the lung

itself is possible. I myself have witnessed a case in which an entire lung was replaced by a putrid, offensive, gangrenous cavity. In the circumscribed form, there may be one or more necrotic foci. In appearance the gangrenous tissues differ greatly in different cases. They may be soft, in which case they are of a brownish or greenish hue; or firm, when they are blackish and contain a small quantity of fluid. As the process advances, the disintegrated tissue is expelled, and a cavity with irregular walls is formed. Circumscribed foci are sometimes surrounded by a line of demarcation with suppuration; the slough is thus loosened and its expulsion aided. The walls of the cavity give forth a purulent discharge. The bronchial tubes resist the gangrenous process longer than any of the pulmonary tissues; indeed, they may sometimes be observed traversing cavities filled with detritus. Ultimately the bronchial tubes within the necrotic area are destroyed, and the products expectorated.

The combined secretions from the cavity are ejected with a certain degree of periodicity, and are exceedingly deleterious in their effects on the mucous membrane with which they come in contact. The discharges sometimes, instead of being expectorated, find their way by ulcerative action into the pleural cavity, setting up an infectious pleuritis. More frequently, however, adhesions first form between the pleural surfaces, so that the opening is made through the thoracic wall. If the process is arrested, a connective tissue development of considerable density forms about the cavity or necrotic focus.

Symptomatology.—As pulmonary gangrene is so nearly always a secondary process, the symptoms must vary considerably, the variance being due to the character of the preceding pulmonary lesion. The symptoms which suggest the supervention of gangrene are the presence of a high degree of asthenia, disproportionate to the physical signs, an increased elevation of temperature, perhaps to a very high point, and very offensive expectoration. The fever is very irregular in its course. Its very irregularity, *i. e.*, its departure from the normal curve of the primary affection, is sometimes suggestive. Later in the course of the disease, when all dead tissue has been cast off, the secretions freely expectorated, and there is no systemic infection, fever may be entirely absent.

In well-developed cases the sputum is rather thin, sometimes sanious, with a greenish, brownish, or blackish appearance, and emitting a horribly offensive odor. The quantity of expectorated matter is sometimes enormous; all of it, however, does not come from the gangrenous cavity. If the sputum is permitted to stand in a glass it settles in three layers; the upper is frothy, muco-purulent, greasy and nummular in appearance; the middle layer is clear, containing, however, some solid particles from the upper one; the lowest layer exhibits a greasy, greenish-yellow appearance, and consists of pus and shreds of tissue.

General symptoms, as chills, sweating, vomiting and diarrhœa are generally manifested, as are also numerous pulmonary phenomena, such as cough, dyspnœa and other symptoms common to all pulmonary affections.

The physical signs are those distinctive of pulmonary consolidation, and of cavities, associated with the râles of bronchitis. These do not, of course, indicate the character of the destructive process.

Diagnosis.—The diagnosis of pulmonary gangrene is in general dependent upon the character of the expectoration, its extremely fœtid odor being *sui generis*. The determination of the condition is easy, if, in addition to this characteristic odor of the sputa, the existence of pulmonary consolidation and excavation can be demonstrated. In differentiating gangrene of the lung and putrid bronchitis, the main reliance must be placed upon the history of the case, for in both the sputum is offensive, and in both cavities exist. The situation of the cavity or cavities may be of no small assistance. In gangrene the process is usually an exceedingly rapid one; in dilatation of the bronchi it is slow. Extremely rare cases of pulmonary gangrene exist without the characteristic expectoration. In these there is usually no communication between the gangrenous area and a bronchial tube.

Prognosis.—The prognosis is most unfavorable. Death always follows the diffuse variety, and recovery in circumscribed cases is the exception. A fatal issue is usually attained within five or six days after the initial chill. Some cases pursue a very chronic course.

Termination. The causes of death may be exhaustion, hæmorrhage, peritonitis, pleurisy, pneumothorax, etc. Perforation may occur into the pleura or peritoneal cavity, or through the chest walls.

Treatment.—The most important measure is the conservation of the patient's strength until all necrotic tissues are cast off. This is best accomplished by a carefully selected dietary and judicious stimulation. Rich broths, milk, etc., should be administered at short intervals. For stimulation nothing is better than alcohol in the form of brandy or whisky. If the expectorated matters are extremely or unbearably offensive, the use of antiseptic inhalations may be demanded. Iodine, carbolic acid, bromine, thymol or creasote are the drugs most used. Antisepsis is best secured by the judicious use of sprays, which serve only to lessen the odor.

The surgical treatment of the gangrenous cavity by incision and drainage has now been attempted successfully a number of times, and is therefore a legitimate procedure.

Experience leads us to claim very little for the action of drugs in these grave cases. Some observers claim to have seen good results follow the use of the great anti-gangrenous remedies, *arsenic* and *lachesis*, but in the few cases I have seen, I must confess to having observed no appreciable result from them.

PNEUMONOKONIOSIS.

Definition.—Under the term pneumonokoniosis is included a variety of conditions dependent upon the inhalation and lodgment of dusts in the lungs. According to the character of the dust producing the lesion specific designations have been employed. Thus, anthracosis, when coal dust is the cause; siderosis, when due to metallic dust, particularly that of iron; chalicosis, mineral dust, as exemplified in the so-called stone-cutters' phthisis or the "grinders' rot;" tabacosis, when produced by tobacco dust; byssinosis, if from cotton fibres and ordinary "dust."

Etiology.—Although dust of various kinds is omnipresent, practically, nevertheless the ill effects arising from the same are not very common. Certain conditions are necessary in order that it shall become an active factor in the production of pneumonokoniosis. The first of these is poor ventilation. Taking, for example, coal miners, in whom this disease is exceedingly common, we find these artisans exposed not only to bad ventilation, but to deprivation of sunlight. Both of these conditions lower the vitality of the subject and increase the dangers arising from dust inhalation. The quantity of dust also has much to do with the results. The pulmonary cilia can protect the respiratory apparatus from the inhalation of foreign particles to a certain extent. The general health of the individual will regulate the resisting power by maintaining tissue integrity. The most injurious dusts are those from iron, steel, flint and various forms of grindstones.

Studies of the effects of dust inhalation in certain occupations demonstrate that workmen thus employed are thereby rendered short-lived. Thus in certain grindstone manufactories the longest any workman has been able to pursue his employment is thirteen years, while the average age of those at work is twenty-four years. In certain coal-mining districts the mortality of the workmen from lung diseases is inordinately large.

Pathology and Morbid Anatomy.—While the mechanism by which dust particles enter the lung substance and thereby set up morbid changes affords an interesting subject for study, space forbids its consideration and necessitates the limitation of remarks to a description of the results. Taking anthracosis as a sample, we find the lungs enlarged and increased in weight. They are deeply pigmented a coal-black color. It is believed that some of this discoloration is dependent upon pigmentary matter from the blood. The surface of the pleuræ is also discolored. Pressure of the affected organs causes the exudation of a blackish fluid. The resulting changes in the pulmonary structures include about all to which these organs are liable. The most important, because the most frequently observed, are the lesions of a chronic bronchitis, with thickening of the bronchial walls and the formation of bronchiectasic cavities.

The bronchial glands may become enlarged, and, by the pressure they exert, excite still further pulmonary changes. The lymph circulation through the lungs is interfered with, which results in the formation of connective tissue formations in the interlobular septa. Thus the natural elasticity of the lungs is impaired and emphysema results. These fibroid changes may be diffused through the entire lung, or they may be more conspicuous in some portions than in others. The pleuræ are generally thickened.

Symptomatology.—The symptoms of pneumonokoniosis present no characteristic features, as they consist of those of chronic bronchitis, bronchiectasis and emphysema, according to the stage at which the case comes under observation. The expectoration is muco-purulent, and often contains particles of the dust which has been the cause of the disease.

Treatment.—The treatment of pneumonokoniosis is identical with that of chronic bronchitis and emphysema, to the chapters on which conditions the reader is referred.

ABSCESS OF THE LUNGS.

Etiology.—The formation of an abscess in one of the lungs necessitates, in the majority of cases, certain predisposing factors, which may be said to consist of all those causes which impoverish the general health. Thus we find alcoholic indulgence, old age, insanity, and certain constitutional and local diseases, as Bright's disease and diabetes, favoring the production of this lesion. The exciting causes of pulmonary abscess may originate within the thorax, as in those cases following pneumonia, intra-pulmonary hæmorrhage, traumatisms, fractured ribs and foreign bodies in the bronchi, empyema, and suppurating bronchial glands. Cases may also result from infective emboli, as in malignant endocarditis. Pulmonary abscesses are not infrequently part of a general pyæmia.

Pathology and Morbid Anatomy.—Abscesses succeeding acute pneumonia are generally single and of large size. Their walls are ragged and irregular; not infrequently their cavities are traversed by bloodvessels and small bronchial tubes which have resisted the destructive process. Their contents consist of pus, floating in which may be found small particles of lung tissue. In the old cases the walls are smooth and lined by a limiting membrane. Pyæmic abscesses are usually of small size and multiple. The thorough evacuation of pulmonary abscesses is sometimes followed by contraction of their cavities and cicatrization.

Symptomatology.—The clinical picture of pulmonary abscess will vary according to the nature of the primary disease. In the case of abscess succeeding pneumonia, the latter disease is observed to pursue an irregular course; possibly it is a more severe attack than usually

observed, and is attended by symptoms of profound asthenia. The temperature possibly runs high, and respiration is considerably embarrassed. These symptoms ameliorate in a measure, and then return with increased vigor, accompanied by rigors, profuse sweats and prostration. The diagnosis of abscess is not, however, made certain until there occurs a sudden discharge of a large quantity of pus. Physical examination at first gives evidence of local consolidation, and subsequently the signs of a cavity are readily discernible, this of course providing the abscess is sufficiently large to be thus recognized.

Diagnosis.—While the diagnosis of pulmonary abscess rests upon the presence of a symptomatic totality such as detailed above, other conditions will present sufficient similarity to it to make a conclusion at times quite a difficult matter. From gangrene it is to be differentiated by the horrible fœtor of the sputum in that disease, and the presence of large pieces of lung tissue in the same. Empyema gives a history showing that the primary seat of disease was in the pleura. The quantity of pus discharged is much larger in empyema than it is in abscess. Sometimes a hepatic abscess ruptures into the chest and is discharged by way of the lungs. Aside from the physical evidences pointing to disease of the liver, we find the pus in the case of abscess of that organ dirty brown or chocolate-like in color, while chemical analysis reveals the presence of bile, and microscopical examinations, portions of liver structure.

Prognosis.—The prognosis of pulmonary abscess is always grave. Many cases recover, and especially is this true in private practice when the patient can be surrounded by every comfort, and brought under good hygienic rules. In any individual case the result is to be predicted upon the general condition of the patient. The prognosis is especially grave in cases resulting from discharge of an hepatic abscess or empyema into the lungs.

Treatment.—The main element in the treatment consists in placing the patient under such conditions as will best conserve his strength and enable him to resist the inroads of a long period of exhausting suppuration. This is to be done by the administration of easily digested and highly nourishing food. In some cases stimulation by alcoholics is absolutely necessary. In addition to these measures, inhalations and means for promoting cough and expectoration as detailed in the article on pulmonary tuberculosis are required. Some cases are best treated by surgical operation. As to remedies, those which will be of the most service are *hepar, silicea, cinchona, arsenicum, arsenicum iod.* and *lachesis.*

HÆMOPTYSIS.

Nomenclature.—Pulmonary hæmorrhage; bronchial hæmorrhage; broncho-pulmonary hæmorrhage.

Definition.—Hæmoptysis is the expectoration of blood in large

or small quantities, the source of the hæmorrhage being the mucous membrane of the respiratory tract below the larynx or the lung parenchyma. The term bronchorrhagia has been applied to hæmorrhage from the bronchial mucous membrane. The clinical use of this latter term is an unnecessary refinement, for it is frequently impossible to say positively from which portion of the respiratory tract the blood proceeds.

It is customary to speak of a true and a false hæmoptysis. The former answers to the above definition; the latter results from hæmorrhage from the mouth, post-nasal space or throat.

Etiology.—Hæmoptysis may arise from quite a variety of morbid conditions. In every case it is but a symptom calling for a most thorough search for other subjective and objective evidences of disease. In many instances it is true these will not be found, not that a primary disease does not exist, but because the pathological lesions are too circumscribed to give other evidence of their presence. There can be no doubt that hæmoptysis sometimes, though very rarely, occurs in young adults in whom the most skilful diagnostician can detect no evidences of disease immediately preceding or succeeding the attack, and whose subsequent career fails to show reason for the hæmorrhage.

The greatest importance of hæmoptysis is attached to its very frequent association with phthisis; in truth, clinical investigations show that in the vast majority of cases it forms but one of the numerous manifestations of that justly dreaded disease. This relationship is generally recognized by the laity, who look upon hæmoptysis and consumption as practically identical. Hæmoptysis may occur at any stage of phthisis. It may give the first note of warning, the patient having hitherto considered himself in perfect health, or its onset may be deferred to the stage of ulceration and cavities.

Other causes for hæmoptysis are observed with much less frequency. Traumatism, as from wounds or blows affecting the chest, may produce it by rupturing the lung. It is sometimes a symptom in the course of congestive or inflammatory pulmonary disorders. Mechanical congestion of the lungs, notably that occasioned by heart disease (especially disease of the mitral valve), the severe paroxysms of whooping cough, alterations in the pulmonary circulation arising from obstruction of the arteries by emboli and tumors, are occasional causes. During the early stage of pneumonia it is observed in rare cases. The relation of hæmoptysis to menstruation forms an interesting subject of study. Numerous cases are on record in which it is claimed that the pulmonary hæmorrhage is but an expression of vicarious menstruation. There can be no doubt that many of these cases are just what they have been claimed to be. It is equally true, however, that in many others, pulmonary mischief has already taken place, and has produced both the amenorrhœa and the hæmoptysis. A too ready acceptance of the doctrine of vicari-

ous menstruation must lull the physician and patient alike into a false sense of security, and waste time which should be occupied by valuable treatment. The assertion that pregnancy and lactation produce hæmoptysis lacks the confirmation of good authority.

Many acute infectious diseases and affections characterized by profound alterations in the blood, as yellow fever, typhus, scurvy, purpura, etc., may give rise to pulmonary hæmorrhage of very severe character. A rare, though very grave cause, is aortic aneurism rupturing into the bronchial tubes, such cases nearly always proving rapidly fatal. The cause of the symptom is sometimes found in the condition of the vessels themselves; *e. g.*, they may be atheromatous, or they may exhibit an abnormal fragility. This latter condition is not infrequently an attendant upon phthisis. A form of hæmoptysis occurring in gouty subjects has been described by Sir Andrew Clarke. This variety, according to that distinguished clinician, occurs in elderly persons, and seems to arise from minute structural alterations in the terminal vessels of the lungs, and is entirely independent of pulmonary and cardiac lesions. The patients are of the arthritic diathesis, causing this variety to be called "arthritic hæmoptysis." A number of instances have likewise been recorded in which the vascular conditions accompanying interstitial nephritis have proven the only assignable cause.

Syphilitic changes in the lungs have undoubtedly caused hæmoptysis in a number of instances, especially when the vessels themselves are also diseased.

There is a popular notion that hæmoptysis is hereditary. Careful investigation does not show that it presents any greater hereditary tendency than do tubercular troubles generally. There is a marked predisposition, however, as to age, the majority of cases occurring between the ages of eighteen and thirty years.

Pathology and Morbid Anatomy.—In the majority of instances the origin of the hæmorrhage is the bronchial mucous membrane. The escape of the blood seems to be related especially to the condition of the capillary vessels of the mucous membrane. These conditions are (1) weakness of the capillary walls; and (2) overdistention. It is the latter condition which gives rise to the hæmoptysis in connection with various pulmonary and cardiac diseases already mentioned. The immediate cause of the bleeding is found in sudden overdistention of the capillary vessels causing their rupture; this may arise from cold, sudden exertion, or strong emotions.

Hæmorrhage is much oftener due to destructive changes in the lung parenchyma occurring from the rupture of dilated vessels in the walls of cavities, or from an ulcerating focus.

The microscopic appearances are variable. Sometimes after apparently profuse hæmorrhages we may be unable to detect the point at

which the flow of blood has taken place. Occasionally, the mucous membrane has a pale, exsanguined appearance. Especially is this apt to be the case if a long period has elapsed between the time of the hæmorrhage and the making of the post-mortem examination. Generally, however, there will be found a puffy, softened and relaxed mucous membrane, of a bright or dark red color, and presenting more or less extensive ecchymotic spots. The alveoli in the neighborhood of the point of hæmorrhage may be filled with blood presenting a pinkish appearance; or the blood may be found in distant portions of the lung substance to which it has been conducted by the bronchial tubes. The bronchial tubes themselves are often found to contain clots which may have lost their color. If the bleeding has occurred from the walls of a cavity, the latter will be found to contain a coagulum, the removal of which will expose the diseased bloodvessel.

Clinical Course.—The onset of pulmonary hæmorrhage is generally without warning. The patient may have previously complained of the symptoms of the primary disease, but has given no evidences of the approaching catastrophe. Frequently, just before the bleeding, there is experienced a saltish taste in the mouth, a slight cough, and then the blood appears. It may be that the blood wells up without even the effort of a cough. The associated symptoms depend largely upon the quantity of blood given off. If the hæmorrhage is a large one, the symptoms are in the main those of a free bleeding from any other locality, *e. g.*, feeble pulse, pallor, prostration, ringing in the ears, and gasping for air. The temporary obstruction of the bronchial tubes adds to these choking, coughing, etc.

The expectorated blood is nearly always bright red and frothy. In quantity it varies greatly in different cases. It may appear only as small streaks in mucous sputa, and coming only with the act of coughing; or it may gush forth in such quantities as to strangle the patient or cause death by exsanguination. In most cases, however, the hæmorrhage is not so profuse as to seriously impair the patient's strength. The blood usually escapes in a fluid condition, but it may be expectorated as coagula.

Marked pyrexia usually characterizes continued hæmoptysis of any severity, or may follow upon a single hæmorrhage, the rise of temperature not infrequently being 103° F. or more. The pulse is always accelerated. The patient is nearly always anxious and excitable.

The attacks have no definite duration. It may be that the patient, without warning, expectorates a large quantity of blood and has no further trouble for months; or the hæmorrhage marks the beginning of a series occurring day after day for a prolonged period. Usually, however, after the first hæmorrhage, others of less quantity occur, the condition gradually lessening until there is only an occasional streak of blood in the sputa.

If distressing cough attends, as it does many attacks of hæmoptysis, it constitutes a feature requiring the physician's careful attention, for a cough of this character interferes seriously with reparative action within the lungs.

It sometimes happens in patients already greatly debilitated by the advanced stage of phthisis, and when the hæmorrhage takes place into a large cavity, that death occurs without any external appearance of blood.

Sometimes the patient swallows the blood, which is then vomited, or it may be passed on into the bowels, thus giving the stools a dark color.

Physical Signs.—In free hæmorrhages especially, moist râles are heard in the larger bronchi. Râles may even be sufficiently localized to indicate the source of bleeding. Generally very little information concerning the hæmorrhage is obtained by a physical examination, unless there is sufficiently well-marked coexisting disease. The greatest care must be exercised in making the physical examination, lest harm be done thereby.

Complications and Sequelæ.—Many able clinicians, notably the late Prof. Niemeyer, considered hæmoptysis as a frequent cause of pulmonary phthisis. It appears quite probable that the changes in the lungs and bronchi resulting from the presence of decomposing blood, which substance may flood portions of the lung during an attack of hæmoptysis would favor the lodgment and propagation of the tubercle bacillus; but it is still more probable that a slight primary tuberculous lesion exists in such cases and that the specific organism is rapidly spread from this primary bleeding focus.

Diagnosis.—As pulmonary hæmorrhage in the majority of cases is symptomatic only, the evidences of the disease to which it bears relationship should be carefully sought. The various pulmonary and cardiac affections with which hæmorrhage is frequently associated are to be diagnosticated mainly by physical signs, in conjunction with a carefully secured history.

Pulmonary hæmorrhage will rarely be mistaken for hæmorrhage from other organs if the patient is seen by the physician in the attack itself. Blood from the respiratory tract is raised by a coughing effort, very seldom indeed by attempts at vomiting. It is alkaline in reaction, bright red in color, and more or less aerated. "Prune juice" sputum is said to be characteristic of pulmonary cancer. The affection with which hæmoptysis is most likely to be confounded is hæmatemesis. In the latter the blood is acid in reaction, dark in color and coagulated. When hæmorrhage from the stomach is very profuse, large quantities of bright red blood, in addition to the dark coagula, may be vomited.

Aneurism may be suspected when a patient has a profuse hæmorrhage without the physical signs of phthisis.

Prognosis.—The outlook, so far as recovery from the attack itself is concerned, is good. Very few cases result fatally. The ultimate prognosis is, on the other hand, decidedly unfavorable, as hæmoptysis is a concomitant of phthisis or other serious disease in the vast majority of cases.

Treatment.—The patient should be at once placed at rest in a recumbent position, with the head and shoulders well elevated. A little reassurance at this early stage is helpful, lessening the excitement and calming the circulation. The food should consist of simple nourishing liquids. To aid expectoration a position partly or entirely upon one side should be selected, and the patient encouraged to expectorate with as little effort as possible. The temperature of the room should be low, but the feet warmed with bottles, and light blankets used for covering. Application of ice to the chest is strongly advocated, and should be used for obstinate bleeding, but it is positively harmful in the arthritic cases. The application should be made as nearly as possible over the bleeding point. Ice may be sucked with advantage. I can speak highly of Chapman's method of applying a water-bag at 120° F. to the cervical and upper dorsal vertebræ. Temporary ligation of the extremities, in order to obstruct the return venous flow without interfering with the arterial current, has received strong commendation as a means of lowering intravascular tension. In the majority of cases of hæmoptysis the bleeding ceases spontaneously, or in response to very simple treatment, while in others it requires the most energetic measures to prevent a rapidly fatal termination.

It is seldom that at least a few doses of *aconite* are amiss in the early stages of the treatment. It is suggested by expectoration of bright frothy blood, excitement, apprehension as to the result, high arterial tension, and a hard hacking cough. It is unnecessary to give this medicine in doses large enough to depress the heart.

While the aconite is acting and various items relating to the care of the patient receiving attention, the character and symptoms of the case should be carefully estimated in order to select a judicious plan of treatment. If of the most common type, viz., occurring in the earlier stages of phthisis, there is usually need for little more. However, if not quickly better, *geranium* in doses of five drops of the tincture, repeated every fifteen minutes to one or two hours, according to the freedom of the hæmorrhage, often appears beneficial. If the blood is dark and plentiful, and does not soon diminish, *hamamelis* is advocated, although my results with this remedy have not been as good as reported by many.

According to Jousset, *millefolium* is much used on the continent for this condition and upon the old indications, viz., a free, easy, light-colored hæmorrhage with little cough. It is also advised for hæmoptysis after injuries (*arnica*). *Ipecac.* is indicated when there is considerable

attending cough, bubbling râles, and in rare cases, nausea and vomiting. *Sulphuric acid* has proven most beneficial in my hands for cases of persistent hæmoptysis, the blood being dark and not marked by great quantity at any time, but by continual oozing. It agrees well with feeble anæmic women. It is best prescribed in ten to twenty drops of the acid in four ounces of water, teaspoonful doses every one to three hours. Sulphuric acid deserves greater popularity than it possesses. *Erigeron* has some reputation for the same dark passive hæmorrhage. *Ferrum phosphoricum* has repeatedly pleased me by its apparent influence over the frequent, slight, bright hæmorrhages, observed in some cases of phthisis. It suits very well certain overgrown youths who have been subject to bronchial catarrh, headache and epistaxis. I have not yet corroborated satisfactorily the "dark and stringy" discharge of *crocus;* nor the profuse bright red hæmorrhage, with violent cough, of *ledum.* During the past year I have used *hydrastinine hydrochlorate,* in the second decimal trituration, with marked influence. This medicine was commended to me by Dr. O. S. Haines, who has employed it extensively. In my own experience no remedy has shown such positive influence over hæmorrhage from any portion of the body. In urgent cases it may be given hypodermatically in doses of one-quarter of a grain.

In severe and repeated hæmorrhages with feeble heart, great prostration, and coolness of the surface, *digitalis* is demanded, often in the tincture, aided by small quantities of alcoholics. *Cinchona* frequently proves a good sequential remedy.

Ergot, and more especially *ergotine,* which have been so extensively employed, I have made use of in some grave cases, but my impressions are not favorable to their continuance; neither do they appear to be prescribed upon altogether rational grounds.

The various drugs having astringent properties, as gallic acid, are now but little employed.

In uncontrollable cases, especially if attended by great nervous excitement and accelerated heart action, the bleeding is often controlled by the use of *morphine,* administered hypodermically in doses ranging from one-eighth to one-third of a grain. This agent should not be used indiscriminately, however, for a cough which enables the patient to expectorate effused blood from the bronchi is essential and to be encouraged. On the other hand, a harassing dry cough, which acts as a constant menace to repair, must be checked and morphine is the remedy which will most surely accomplish this result temporarily.

When hæmoptysis is associated with acute heart disease (endocarditis) *spigelia, cactus, ferr. phos.,* and *aconite* are the most important remedies from which to select; but when due to chronic obstructive lesions, *digitalis, caffeine, arsenicum,* and other remedies acting as cardiac stimulants, are preferable.

HYPERÆMIA OF THE LUNGS.

An active and a passive congestion of the lungs is recognized, some authors separating mechanical congestion from the latter and making of it a third form.

ACTIVE HYPERÆMIA.

This term indicates an active afflux of blood to the lungs, a condition constituting the early stage of the various inflammatory affections of these organs. It is a state which is not recognized by all as existing independently of defined disease of the lungs and has consequently led to considerable discussion. The French especially recognize it as a primary affection, calling active hyperæmia the "maladie de Woillez."

Etiology.—The causes of active hyperæmia are essentially those that excite inflammation of the lung tissue. Pre-eminent among these are cold, irritants, *e. g.*, inhalation of the fumes of some chemical substances, of irritating particles, or of very hot or very cold air; inflammation of adjacent structures, or obstruction to the flow of blood through one portion of the lung, such as may follow upon embolism or the destruction of capillary vessels. It may attend violent heart action excited by physical exertion, by excitement, or however produced. Acute alcoholism is a common cause, but often associated with exposure of various kinds and the worst of habits. In some degree, it follows upon rapid lessening of the atmospheric pressure within the chest cavity, *e. g.*, such as occurs during violent efforts at inspiration with closure of the glottis, as in laryngismus stridulus, croup, pertussis, etc. Predisposition is a prominent factor.

Anatomical Features.—The vessels of the lung are distended, and the mucous membrane of the bronchi may be injected; there is consequently a higher degree of color of these tissues. Some degree of œdema results, indicated by the flow of frothy blood-stained serum from the cut surface of the lung. Vesicular catarrh is not a rare feature. Should embolism or other local cause of circulatory obstruction have been the cause, there may be hæmorrhage into the lung parenchyma. This is seldom present in any great degree in the absence of organic lesions. The lung is still crepitant and floats upon water. Some deaths have been ascribed to coexisting disease of the coronary arteries.

Symptoms.—The symptoms do not constitute a clear-cut or characteristic group. They consist of a high degree of dyspnœa; cough, with stitching pains; expectorations, which may be bloody or of a rusty color, contain considerable blood, or develop into a free hæmoptysis. Fever is slight and the onset may be by chill. Physical examination of the chest reveals a feebleness of the respiratory sounds which may sometimes, however, approximate to the bronchial character, there is some

impairment of resonance, which may be quite general in its distribution; râles may be present, the most characteristic being the subcrepitant.

Diagnosis.—The most important features of acute hyperæmia of the lungs are its sudden onset, with the evidence of some determining cause, great oppression of breathing, and negatively, an absence of the physical signs of pneumonia or other well-defined form of acute pulmonary disease. The separation of an acute hyperæmia from unusual forms of pneumonia is at times impossible. The presence of numerous pneumococci in the bloody sputum of a case lately under my care made its true nature clear. Instances in which a rapidly fatal result takes place are in all probability cases of ill-defined pneumonia in which the patient is overwhelmed by the intense hyperæmia.

Resemblance to œdema of the lungs is strong, the latter affection being undoubtedly often mistaken for active congestion, and as œdema of the lungs is often attended by a high degree of congestion, and active hyperæmia by some degree of œdema, a positive separation cannot always be made.

Prognosis.—True active hyperæmia is but a transient condition, death occurring from the intense and general character of the congestion, or it quickly subsides with recovery of the patient, or it may form but the initial stage of a pneumonia.

Treatment.—The general treatment must be of the same character as that instituted for acute inflammatory affections of the lungs. Rest in bed, a liquid diet, active bowels, heat to the extremities when necessary, and an avoidance of alcoholics and all stimulating agencies, are the most important items. The cause of the hyperæmia should receive especial attention.

The medicines called for are the same as have been recommended for the early stage of pneumonic fever, viz.: *aconite, ferrum phos., veratrum viride,* and occasionally *belladonna* or *phosphorus.* If the symptoms resemble those of pulmonary œdema, *tartar emetic* is the most efficient remedy. Very hot, large poultices, applied to the chest over a thick layer of flannel, afford great relief and exercise a beneficial influence upon the hyperæmia; also the free use of dry cups. The same may be stated of hot foot-baths. These several means will render unnecessary the abstraction of blood, which is advocated by many.

Passive hyperæmia includes two forms: (1) hypostatic, (2) mechanical or obstructive hyperæmia.

HYPOSTATIC HYPERÆMIA.

Hypostatic hyperæmia involves the bases of the lungs and is the result of the combined influence of feeble heart, altered blood and blood-vessel walls, and finally, of gravity. It is met in most protracted infectious diseases, during the course of which the patient becomes greatly

exhausted, and lies almost constantly upon the back. It appears more frequently in the aged and feeble, in whom it is a prominent factor in the determination of a fatal issue. It is also observed as a sequence of surgical operations. Quite a variety of affections of the nervous system are attended by congestion of the bases of the lungs, especially cerebral hæmorrhage, traumatic affections, tumors of the brain, etc. It also attends many cases of opium and carbonic acid poisoning. In these cases there may be superadded to the hyperæmia changes in the lungs consequent upon the aspiration of food.

Morbid Anatomy.—The morbid changes are most pronounced in the bases of the lungs posteriorly. The involved areas are of a dark bluish color. The lungs are not equally involved, the distribution being governed by the position occupied by the patient during the latter days of the illness. Upon minute examination these areas are found engorged with blood and serum, and the alveoli containing a good many epithelial cells and exudation corpuscles. A portion cast into water sinks. There can be no doubt but that much of this change is of a post-mortem character, the blood gravitating to the most dependent portions of the lungs, but that in some degree it precedes death is demonstrated by physical signs. Œdema is a more prominent feature of this process than is generally conceded. In some instances the consolidation process attains such a degree that a species of pneumonia is developed (hypostatic pneumonia). The resemblance of the altered lung tisssue to an engorged spleen has led to the application of the term "splenization."

Symptomatology.—The symptoms of this form of hyperæmia are not of such a character as to point strongly to its presence. The most dependence must be placed upon physical examination in association with a history of favoring conditions. There is dulness, which is usually greater over the base of one lung, representing the side upon which the patient has rested the more during the last days of his illness. The breath sounds are feeble or bronchial, and there are fine, moist râles. In aggravated conditions there may be a cyanotic hue of the skin, which is most conspicuous in the lips and extremities, and a high degree of prostration. In the course of diseases in which hypostatic congestion is a common feature it is wise to make frequent examinations of the posterior surface of the chest, in order to detect its development at as early a period as possible.

Prognosis.—The dependence of hypostatic congestion upon a variety of prostrating diseases indicates that the prognosis of this condition is dependent upon that of the primary affection, but whatever estimate may have been formed of the patient's progress the development of congestion of the bases of the lungs, or progressiveness of an already existing congestion, is positive evidence of failure and demands a reconsideration of the various items of treatment.

Treatment.—The treatment is mainly that of the primary affection. More careful attention to the position of the patient, who has perhaps been permitted to lie constantly upon his back, greater care in the selection of food and in the dosage of stimulants and remedies, attention to the skin and bowels, and the employment of rectal enemata of food, constitute the most important items of treatment. While the condition of the lungs should be considered in the selection of remedies, that medicine which most perfectly meets the general condition is the one likely to best control the lung changes.

Phosphorus, arsenic, rhus toxicodendron and *muriatic acid* are most frequently useful, and occasionally *ammonium carb., tartar emetic, digitalis, lycopodium*, etc.

MECHANICAL OR OBSTRUCTIVE HYPERÆMIA.

The *mechanical or obstructive form of hyperæmia* is due to conditions preventing the free flow of blood from the lungs into and through the heart, a state presenting features which separate it from either the active or hypostatic forms.

Etiology and Morbid Anatomy.—Any condition or combination of conditions of the left heart which obstructs the circulation, *e. g.*, mitral regurgitation or obstruction, dilatation of the left ventricle, or the advanced period of aortic disease may give rise to a mechanical hyperæmia of the lungs. The same result may also follow compression by new growths. The connective tissue of the lungs proliferates and is increased in density to such an extent that Rokitansky called it inflammatory hypertrophy of the connective tissue. The larger bloodvessels are dilated and their connective tissue sheaths thickened. The capillary vessels are engorged and tortuous. The current ceasing in some, they may be traced as lines of brownish pigment matter. The lungs are large and of a brownish color (brown induration), and upon section quickly become of a much brighter hue from oxidation of the exposed hæmoglobin. Hæmorrhage into the connective tissue results in pigmentation of its cells. Some blood finds its way into the alveoli, tinging the sputum. The changes involve both lungs in uniform degree. They are enlarged and abnormally tough. The loss of elasticity is somewhat compensated by hypertrophy of the muscular fibres which surround the infundibula. Foci of old and recent hæmorrhages are represented by consolidated areas which vary in color according to age. There is more or less œdema present; also catarrh of the mucous membrane of the bronchi. As the subjects of disease of the left heart are in most instances young persons, it follows that brown induration is met most frequently in persons below middle life.

Symptoms.—The symptoms are closely associated with those due to the primary heart lesion. Cough, dyspnœa, palpitation and oppres-

sion over the lower portion of the sternum or in the epigastrium, are common symptoms, and much aggravated by exertion. Free hæmoptysis is not uncommon, and minute quantities of blood in the sputum are a frequent feature with some patients. There may be paleness or cyanosis. The microscope reveals pigmented cells in the sputum. Added to the above symptoms there are the signs and symptomatic features of the form of heart disease which gives rise to the mechanical hyperæmia. A feeble, small pulse, fine inspiratory râles, or coarse moist ones during the acute attacks of bronchitis which occur occasionally and lead to general aggravation of the symptoms, are the most important physical signs.

Diagnosis.—The frequency with which well-marked pulmonary obstruction attends chronic heart disease suggests physical examinations of the chest, especially if the patient complains of dyspnœa, cough, and, perhaps, spits blood. If under these circumstances fine, generally distributed, crepitant râles are discoverable, the nature of the pulmonary condition can be stated.

Prognosis.—The progress of mechanical hyperæmia depends upon that of the cardiac affection which causes it. The latter may be of such a nature as to keep up a persistent hyperæmia of the lungs for years, with the development of brown induration in its most typical form. Increase of dyspnœa and cough and the frequent occurrence of hæmoptysis are unfavorable indications. The appearance of cyanosis is an indication of rapid failure.

Treatment.—Treatment is directed to the disease of the heart which excites the pulmonary hyperæmia, the control of which is essential to any degree of improvement in the lungs (see Treatment of Valvular Diseases of the Heart, page 92).

ANÆMIA OF THE LUNGS.

A less important affection of the lung than hyperæmia, by reason of its infrequency, is anæmia.

Etiology.—Anæmia of the lungs may be dependent upon hæmorrhage, and is then but a part of a general anæmia, or it may be due to local causes and stand quite alone. Local conditions capable of causing pulmonary anæmia are embolism, thrombosis, and stenosis of the pulmonary artery or some of its branches; neoplasms, particularly of a malignant character, which may compress or invade the lumen of the pulmonary vessels; emphysema, which destroys large numbers of the capillaries, or aneurism of some portion of the pulmonary artery with consequent impairment of the blood supply to a portion of the lungs.

The apices of the lungs are normally relatively anæmic, which is probably one of the reasons why they are prone to early attack, *e. g.*, in phthisis.

Morbid Changes.—These are paleness, dryness, bloodlessness, and in some forms, slight œdema. The lungs may be lighter or heavier than normal, this being governed mainly by the existence or not of œdema. Continued anæmia may be the cause of atrophy of the lung structures. When a sufficient degree of obstruction takes place, as in thrombosis of the pulmonary artery, there may be disintegration of the parts from which the blood current has been cut off. In high degrees of anæmia of a portion of the lung, hæmorrhage from the hyperæmic tissue which surrounds the bloodless district is not unusual.

The **Symptoms** of pulmonary anæmia are mainly the outgrowth of a greater effort for air, which is the necessary result of a great loss of blood corpuscles; or, of local conditions which prevent the entrance of the normal amount of blood into the lungs. Increased rapidity of respiration, gasping, restlessness, oppression of the chest, and excited action of the heart, are the most important symptoms. Associated with and obscuring in some degree the symptoms of pulmonary anæmia are those dependent upon the underlying affection.

The **Prognosis** will depend almost entirely upon the nature of the condition causing the anæmia.

Treatment.—There is no treatment which can with advantage be directed to the pulmonary anæmia. Some relief may be secured from inhalations of oxygen, keeping the patient at rest, and endeavoring to improve the general nutrition. Specific treatment should, as far as possible, be directed to the cause.

SECONDARY PNEUMONIA.

Inflammation of the lungs occurring in the course of some definite form of disease is spoken of as a "secondary pneumonia." In many instances of this kind, an etiological relationship apparently exists between the primary disease and the pulmonary inflammation; in others, this cannot be determined.

When the pneumonia is of an ordinary type and occurs, so to speak, as an accidental infection or development, it is called "intercurrent pneumonia," in contradistinction to the secondary form which we have seen bears a closer relationship to the primary affection. It is also necessary to separate the "hypostatic pneumonia" (page 301), which is not a true pneumonia, from that under consideration.

Etiology.—Such complicating pneumonias may occur in persons who have been long confined to bed from any cause; in association with various forms of acute infectious disease, especially the acute eruptive diseases and the fevers, Bright's disease, heart disease, diabetes and pyæmia. It also occurs after surgical operations, and in connection with various affections of the cerebro-spinal system.

Morbid Anatomy.—The morbid changes are much the same in kind as those which characterize the primary forms, with a preponderance in many cases of epithelial proliferation. There is also a greater tendency to involvement of the upper lobes of the lungs, and to bilateral lesions.

According to Delafield and Prudden, the process may present one of two types: "(1) Part of the lung, usually the posterior portion, is congested, leathery, only partly aerated, and mottled by irregular patches of red or gray hepatization which have no relation to the bronchi. In the hepatized portion of the lung the air spaces are filled with pus and fibrin. (2) The inflammation has the characters of a broncho-pneumonia. The small bronchi are filled with pus, their epithelium is altered, their walls are infiltrated with pus, and around each bronchus is a zone of air vesicles filled with pus and fibrin. The lung is mottled with little whitish nodules corresponding to the bronchi and the peribronchitic zones, and between these there may be a diffuse hepatization."

"In children suffering from diphtheria, with pseudo-membranes containing pathogenic bacteria in the fauces and upper air passages, a secondary pneumonia may apparently occur as the result of the entrance into the lung spaces of the germs from above. Although the pyogenic bacteria are the most frequent inciters of secondary and complicating pneumonia, other forms of germs are capable of inducing it."

The special changes found in the lungs in association with diseases of the heart have been considered under the head of obstructive hyperæmia.

Symptoms.—The association of pneumonia with a primary affection influences its clinical course in a marked manner, the tendency being to obscurity and latency. The pneumonia is usually robbed of its acute onset, chill being generally absent and the cough, pain, dyspnœa, and fever, may all be of moderate degree, or some of them absent. There is, however, a high degree of prostration and a tendency to the early development of the typhoid group of symptoms in many cases. The physical signs are the same as are associated with the catarrhal and fibrinous types when these are developed as primary affections.

Diagnosis.—In view of the ill-defined symptomatology of secondary pneumonias, it is obvious that physical exploration must occupy the most prominent place in determining the existence of the lung lesion. One will but seldom find the marked consolidations which are discovered in primary pneumonia. When involving the upper lobes there is sometimes a strong resemblance to phthisis. Under these circumstances the sputum should be examined for the bacillus of tubercle. When the lower lobes are involved the resemblance to hypostatic congestion is considerable.

Prognosis.—While a secondary pneumonia forms a serious complication in many affections, it is not infrequently ill-developed and undergoes early resolution. A true estimate of the result cannot be made during the early period of the attack, as many cases manifesting a sharp onset are quickly robbed of their activity, while some cases with insidious development grow persistently worse.

Treatment.—This is conducted in the same manner as that of the primary forms, giving especial attention to the control of the primary affection, and to rest, food, and stimulants.

Diseases of the Pleura.

PLEURISY.

The frequency with which inflammation of the pleural membrane occurs, as well as its immediate and ultimate danger to life, invests this disease with an interest which demands more careful study of its peculiarities than is ordinarily devoted to it by the general practitioner. Its frequency in some form is shown by the fact that few cadavers, no matter what may have been the cause of death, are free from some degree of pleural adhesion.

Synonym.—Pleuritis.

Definition.—An inflammation involving the whole or part of one or both pleuræ.

History.—The term pleurisy is one that has been used in medical parlance for centuries. In ancient times, however, it carried with it a very different meaning from that which it indicates at the present time. Hippocrates used the term to designate all pains in the side, especially those of a severe character, a usage that was etymologically correct. Pleurisy was also mentioned by Celsus and Galen, the latter doing considerable towards properly defining the disease and adding to the then existing knowledge of its treatment. From the days of these fathers of medicine up to the period of Laennec knowledge advanced slowly. Pleurisy became recognized as an inflammation of the pleural membrane, but authorities differed as to whether it had an existence apart from inflammation of the lungs. Laennec, in this as in many other matters pertaining to diseases of the chest, made the first real advance in our knowledge, and demonstrated the physical signs of pleuritic inflammation. He showed that inflammation could commence in the pleura and be limited thereto in some instances, while in others it involved the lungs also.

Etiology.—For all time cold has been considered as the most important factor in the production of pleurisy. But the relationship existing between cold, as a causative agent, and pleurisy has undergone a readjustment during the past few years. While still forced to look upon it as sometimes the cause, it has been demonstrated satisfactorily that in most instances it is an exciting agent only. The microbic origin of pleurisy has been strongly advocated of late, especially in France and Germany, and bacteriological evidence of a satisfactory character has

been brought forward in abundance. A variety of germs seem capable of exciting it, notably pneumococci, pyogenic streptococci and staphylococci, Friedländer's encapsulated bacillus, the bacillus of Koch, the pseudo-typhoid bacillus, etc. Renzi believes that pleurisies are caused largely by the germ of the prevalent epidemic, claiming that streptococcus cases prevailed during the recent epidemic of influenza. Organisms are not always to be found. It seems probable that the enthusiasm generated by this important discovery in the etiology of pleurisy, and especially in its relation to tuberculosis, has led to too great claims, and as a matter of fact, they are already undergoing modifications. One author * goes to the extent of defining pleurisy as "infection of the pleura by the diplococcus, streptococcus, tubercle bacillus, etc." The tuberculous origin is based not only upon the presence of the specific organism in the exudate or tissues, but upon the number of persons possessing coincident pulmonary tuberculosis, or who apparently develop the latter disease consecutive to pleurisy. The last-mentioned fact may be misinterpreted, however, as the resulting pathological changes of pleurisy may merely develop a favorable soil for the implantation of the tubercle bacillus, the individual having been previously healthy and immune from infection.

While thus cautioning against extreme views before their truth is fully established, I would suggest a careful consideration of the doctrine that very many primary pleurisies are but the expression of a local tuberculosis. The best exposition of this theory is found in an article by Barrs. This investigator, taking from the records of the General Infirmary of Leeds all the cases of pleurisy occurring between the years 1880 and 1884 inclusive, and considering those only in which the presence of effusion was undoubted, the pleurisy not secondary to any other disease, as pneumonia, etc., and in which the pleurisy appeared to be spontaneous or to have arisen from cold, reaches a conclusion that a very large percentage of them is apparently of tubercular origin. Thus of 114 cases coming within these limitations, 40 were cases of empyema and 74 were cases of pleurisy with effusion. Of the latter, at the time of writing, 32 were dead, 25 living and 17 could not be traced. There was thus a death-rate in those who could be traced of 57 per cent. "As to the duration of life after the onset of the disease, there died in hospital 3, died the day after leaving the hospital, 1. In the remaining 28 cases the average duration of life was two and a half years, the maximum being five years and the minimum six months. The causes of death in the 32 cases were as follows: Known phthisis, 14; probable phthisis, 1; hip disease, 1; tubercular meningitis, 1; acute tuberculosis, 1; pleurisy, 3; dropsy, 2; hydropericardium, 1; unascertained causes, 8." Twenty-one out of thirty-two cases thus died of some tubercular disease. Careful

* Whitaker: "Practice of Medicine," p. 542.

investigation of the non-fatal cases disclosed no differences from those subsequently dying of tuberculosis.

Barrs furthermore presents some clinical arguments in favor of the tubercular origin of pleurisy. He directs attention to the fact that other serous membranes are not affected primarily by cold, but are frequently the seat of tuberculous disease. The failure to find tubercle bacilli in the effusion is simply negative evidence, and of comparatively little value. The main argument against tuberculosis as the principal cause of pleurisy is found in the small primary mortality of the affection. Still we find analogies in other local tuberculous troubles, which are very frequently recovered from.

Bowditch's statistics point in the same direction. Of ninety cases of pleurisy treated, between 1849 and 1879, thirty-two died of or had phthisis.

Dr. A. A. Smith, of New York, contends that the tubercular origin has not been proven, and uses Bowditch's figures in support of his position. Osler believes that, with increasing experience, his faith in the tubercular origin of acute pleurisy increases.

The associations of pleurisy are many and diverse. It may be excited by traumatism, or may develop by extension from adjacent structures. The conditions of neighboring organs favorable to its development are pneumonia, tuberculosis, cancer, embolic processes, abscesses and gangrenous foci of the lungs; also various affections of the mediastinum, of the large bloodvessels and of the parietes of the chest. It is also occasionally associated with the various infectious diseases and with Bright's disease. It may, by extension along the lymphatics, occur in association with peritonitis.

Fiedler contends for a rheumatic pleurisy, and believes that acute arthritic rheumatism is frequently associated with inflammation of the pleura, pericardium and endocardium. The severity of the rheumatic trouble has nothing to do with the pleurisy, which may follow a primary trouble so slight as to be readily overlooked.

Morbid Anatomy.—In the earliest stage of pleurisy the membrane is found injected and dull from the presence of coagulated fibrin upon its surface. With the progress of the inflammatory process the exudate varies in character. In some, fibrinous material accumulates upon the surface of the pleura until the latter becomes more or less thickened and presents a roughened, shaggy surface; or the exudate may be of a serous character, and present in such quantity as to seriously compress the lung and displace the heart, liver and other organs. In others the pleural effusion undergoes purulent transformation, or it may be purulent in character from the beginning. These characteristic exudative features form the basis for the pathological divisions into (1) fibrinous, dry or plastic pleurisy; (2) sero-fibrinous pleurisy; (3) purulent pleurisy or empyema.

Fibrinous or Plastic Pleurisy. This form may result from exposure to cold, but is generally attendant upon croupous or extensive catarrhal pneumonia, abscess, gangrene, or cancer of the lungs; but of all causes tuberculosis of the lungs is the most frequent, there being but few cases of the latter disease that have not developed one or more attacks of dry pleurisy. This form of pleurisy is generally limited in its area of development, and it is seldom that there is any quantity of serous exudation accompanying it. Consequent adhesions are common.

Sero-fibrinous Pleurisy. Sero-fibrinous pleurisy differs from the localized fibrinous variety, (1) in the more general distribution of the inflammatory process over the pleural tissue, (2) in the predominance of serous over fibrinous exudation. The free serous accumulation is its special characteristic. Fibrin is always associated, but there is considerable variation in the amount present. One extreme is represented by the presence of the slightest quantity, the other by considerable areas of pleural membrane covered with plastic exudate, and quantities of fibrinous flakes in the accumulated fluid.

This form of acute general pleurisy is at least generally of microbic origin. It is the form which can so often be demonstrated to be of tubercular origin, that Strümpell and others have designated it as tubercular pleurisy. The large effusion present in this form of pleurisy may effect extensive displacement of the heart, liver and adjacent organs. The rapidity of development of the effusion varies much; the quantity and specific gravity also. Sir Thomas Watson reports Crampton, of Dublin, as withdrawing fourteen imperial pints in one case. The fluid is usually yellowish in color, alkaline in reaction, in some degree translucent, and contains more or less of fibrinous particles. Sometimes these latter are found in such large quantities as to form comb-like masses. Some degree of purulency of the exudation is indicated by a greenish-yellow sediment upon standing.

The general composition of the fluid may be compared to that of blood serum. Microscopical examination shows a variable amount of leucocytes and red blood corpuscles. No account is taken of the latter unless the blood be present in sufficient quantity to give the effusion a characteristic color.

The effect of the effusion on the lung is both interesting and important. The compression exerted by it at once lessens the volume of that organ and displaces it. In extreme cases the lung is pushed well upward and back against the vertebral column. Its contained blood and air are driven from it, and it becomes a solid mass. It will then sink if thrown into water, but it can be inflated.

Other organs likewise suffer displacement. In right-sided pleurisies the liver takes a lower position, and in left-sided the stomach is crowded downward and the heart is pushed over to the right.

Purulent Pleurisy or Empyema. A purulent character of the exudation is observed to be present so soon after the beginning of some pleuritic inflammations, especially in children, that we are justified in recognizing a primary purulent pleurisy. The reason for purulency is not positively established, although it is probably due to infection. Constitutional states may have an influence. Empyema may occur as a sequence of the acute infectious diseases, especially of scarlet fever and typhoid fever, and less frequently of pneumonia, whooping cough, measles, etc. A few pleurisies of phthisical origin, resulting generally from rupture into the pleural sac, are attended by a purulent exudate. Diseases and injuries of surrounding tissues may develop a similar result. For example, it has followed fracture of the ribs, penetrating wounds of the thorax, and malignant disease of the lungs and œsophagus. Air may enter the pleural cavity, resulting in a pyo-pneumothorax. The exudation is essentially pus. After death, it separates into two layers, the upper consisting of a clear, greenish-yellow serum, and the lower a thick pus. The cause of the trouble has some influence on the characteristics of the exudate. Ordinarily it has little or no odor, but when the disease is dependent upon penetrating wounds or malignant pulmonary disease, it is horribly offensive.

The pleural membrane becomes greatly thickened, even to one-twelfth of an inch.

The principal symptoms are those of septic infection, viz., chills, fever, prostration, wasting, sweats, cough, pain, and dyspnœa, all of which vary much, but are usually moderate as compared with acute general pleurisy. The onset is generally insidious.

A purulent accumulation results in erosions and in perforation unless removed by operation, the pus bursting through an intercostal space and appearing externally, into the lung structure being expectorated, or through the diaphragm entering the peritoneum, stomach, or following the psoas muscle. Rarely it may perforate the pericardium, œsophagus, or follow some unusual long or tortuous path.

Consequences of Pleurisy. In simple dry pleurisy, adhesions sufficiently close and extensive may occur to lead to consequent pain which may be long continued. By gradual stretching of these pseudo-membranous bands, sufficient elongation may occur in time to lead to relief. The thickened area remains hyperæmic and sensitive often for a long time. The pain is generally aggravated by breathing, exercise and weather changes.

Acute general pleurisy is marked by more serious results. The effusion may become bloody (hæmorrhagic), the blood being extravasated from the hyperæmic capillaries of the pleura, or more likely, from delicate newly formed vessels in the organizing exudate. The exudate may become purulent; or putrefactive agents gaining access to the

pleural cavity, which occurs when pleurisy follows pulmonary gangrene, leads to an ichorous putrid effusion. Accumulations of fluid amounting sometimes to several quarts bulge the pleural cavity, making prominent the intercostal spaces, displace the heart, liver and neighboring organs, and compress the lung against the spine, where it lies, dark in color and containing little or no air. Many or all of these symptoms arising from pressure may be prevented by adhesions.

In the majority of cases of sero-fibrinous pleurisy, absorption of the fluid with recovery of the patient follows. The time required for absorption varies from days to many weeks. The layers of fibrinous exudate undergo semi-organization, the two thickened pleural membranes adhere over greater or less areas and the lung becomes thus, in some degree, adherent to the wall of the chest.

Hæmorrhagic Pleurisy. A bloody effusion in pleurisy is met under a variety of conditions. In determining the nature of a case with fluid of this character, the fact that the introduction of the needle of the aspirator may wound the lung or a thickened vascular membrane, and thus develop a bloody fluid, must be borne in mind. Cancer, Bright's disease, cirrhosis of the liver, the various forms of infectious fever, and tuberculosis, may be enumerated as furnishing most examples of this form of pleurisy.

Encysted Pleurisy. The exudate is not always freely movable in the pleural sac on account of the pocketing of the fluid in spaces formed by adhesions between the pleural surfaces. It is not uncommon to discover several such spaces, especially in cases with a purulent fluid. Such a confinement or encysting of the exudate is sometimes observed between the lobes of the lung, and is the result of involvement of the interlobar pleural surfaces which become adherent peripherally.

Symptoms.—The most prominent of the local symptoms is pain, which is of a sharp cutting character, and aggravated by breathing, coughing, and motion of the affected parts from any cause. Rare cases are reported in which pain has been so slight as to hardly attract attention to the nature of the disease. The location of the pain varies according to the site of the developing inflammation. It is most frequent in the side of the chest, infra-axillary region, or anteriorly near the nipple. In the exceptional instances of involvement of the diaphragmatic portion of the membrane, the pain may be felt in the lower portion of the back or in the abdomen. The onset may be with a chill and the rapid supervention of acute symptoms, which may or may not be preceded by prodromes. The lesson that pleurisy is not always heralded by typical symptoms, that it very often creeps on insidiously, and further, that in a few cases, the general symptoms may be even more pronounced than the local, is being learned. If the patient's power of resistance is above the ordinary, he may even keep at his occupation for several weeks, the

services of a physician being at last secured on account of feebleness, dyspnœa, etc. The temperature elevation is usually moderate, seldom exceeding 103° F. The duration of the fever is variable, being from a week to three or four weeks, and its disappearance often taking place while the chest still contains the maximum of exudate. From the beginning there is a short, hacking cough; expectoration is seldom a pronounced feature. Dyspnœa appearing in the early stage is due especially to the pain, but later it is proportionate to the amount of crippling of the lung incident to the pressure of the accumulated fluid. The degree of oppression is much affected by the rapidity with which the effusion takes place, extreme distention of the pleural sac causing but little interference with breathing while the patient is at rest, providing it has developed slowly. A position on the back or painful side is, as a rule, selected by the patient.

Emaciation and feebleness increase with the progress of the disease. The appetite is deficient, the bowels are constipated, and there may be vomiting. If the effusion is large and rapidly developed, some degree of cyanosis will be present. The urine is generally lessened in quantity, a phenomenon usually ascribed to diminished arterial tension. With rapid absorption of the pleural effusion, the urine increases rapidly in quantity, sometimes to from four to six pints in the twenty-four hours.

The general course and duration of pleurisy varies within wide limits. Cases coming on with very acute symptoms are more apt to run a rapid course. Those developing insidiously are usually protracted and freer from distressing features, although a quiet, tedious case may at any time, as the result of a sudden increase in the effusion, develop severe oppression, cyanosis and other severe symptoms. The duration of the disease is from one to two months.

Involvement of the diaphragm is suggested when the pain is referred to the hypochondrium and extends to the back, or even to the shoulder. If the left side is attacked, there may be vomiting with singultus and pain in the stomach. Jaundice has been associated with right-sided attacks. Occasionally, pain is complained of as food passes through the œsophageal foramen. Examination reveals limitation of motion over the lower portion of the chest upon the affected side, and in the same region over which the respiratory sounds are enfeebled. Tenderness may be present along the insertion of the diaphragm, especially in the last intercostal space near the spine. When present, friction sounds are most frequently heard over the semilunar space upon the left side.

Physical Signs.—The amount of fluid in the pleural sac which is necessary for detection cannot be positively stated, but it is probable that at least from six to ten ounces are required for this purpose.

Inspection reveals impaired motion of the affected side, which appears enlarged, and the intercostal spaces in some degree effaced, even

protruding. The latter, however, is undoubtedly very rare. Change in the position of the heart is quite constant, the direction of displacement depending upon the side upon which the accumulation of fluid has occurred. If upon the right side, the apex beat is carried to the left and upward, even into the left axilla, the amount of displacement depending upon the quantity of fluid present. If upon the left side, the heart's impulse is often obscured, but with free effusion it may be found well to the right of the sternum, even as far out as the nipple line, and elevated to the fourth and even to the third intercostal space. Dislocation of the heart, as can be readily imagined, is much greater in association with left- than with right-sided effusions. Abnormal prominence of the hypochondria, especially of the right, may result from the enforced descent of the diaphragm. Pulsations of the affected side were first described by Macdonnell, of Montreal, but they occur very much oftener in association with purulent accumulations. So marked is this sign that its presence strongly suggests empyema.

Palpation as well as inspection reveal limitation of motion upon the affected side, as it does also the filling out or obliteration of the intercostal spaces. It also assists in defining the position of the heart. The degree of abolition of voice fremitus bears a close relationship to the amount of exudation. There are, however, exceptions to this rule, which is emphasized by Loomis. Some observers think that the exceptional cases occur oftener in children. The preservation of vocal fremitus may occur through localized pleural adhesions.

Fluctuation is rarely detected. A doughy, œdematous state of the chest wall may be perceptible to touch, and suggests the presence of purulent effusion.

Mensuration. Measurements of the chest may be employed to determine the relative size and power of expansion of the halves of the chest. It must not be overlooked that the right chest is normally larger than the left. The cyrtometer of Gee is useful for mensuration purposes.

Percussion. Percussion resonance diminishes with the accumulation of fluid and consequent interposition of a solid medium between the lung and the chest wall, until, in cases of large effusion, absolute flatness exists over all but the upper portion of the chest, which is more or less dull. As collections begin in the lower portion of the pleural sac posteriorly, dulness will first appear at that point and be discernible anteriorly only after a considerable quantity of fluid has been effused. The sense of resistance to the percussing finger is in direct ratio to the loss of resonance. Percussion presents the most reliable method of determining the rate of increase of the fluid. The lung above the upper edge of the effusion, often, as has been shown by Skoda, gives a tympanitic note. This is most pronounced below the clavicle, although it is usually demonstrable posteriorly above the fluid line. Williams

called attention to a change in pitch upon opening the mouth. This sign is known as "the tracheal tone of Williams." There is usually, upon change of position of the patient, a corresponding alteration in the upper line of dulness; at least, it is so stated by most teachers. My personal experience is more in accordance with the statements of Fagge, who does not find gravitation of fluid upon change of position so constant or so pronounced a sign as authors would lead us to suppose. Statements upon this point have always seemed to be largely theoretical. The especial reason for the non-gravitation of fluid is stated by Fagge upon the original authority of Moxon, to be total collapse of the lung tissue which ought to occupy that space. It is especially interesting to note that such collapse occurs in association with the "effusion of moderate quantities of liquid into the pleural cavity." The experiments of Garland explain the long-known fact that, with the body erect, the upper line of the effusion as determined by percussion, is not upon a horizontal line plane, the line of dulness describing a modified "S." It is suggested that inflation of the triangular portion of the lung which dips beside the spinal column be accomplished by a few deep inspirations before commencing the examination. Traube has called attention to a dulness of a semilunar space over the lower left costal cartilages due to descent of the diaphragm, which with its contained fluid now occupies a region normally occupied by the stomach. Percussion resonance is exaggerated and extended over the normal side. Persistence of dulness after absorption of the fluid is common, and due to thickened membranes, and probably imperfectly expanded lung. In some degree, this condition may continue for years or for life.

Auscultation. The pleural friction sound is heard until the roughened surfaces are separated by the accumulated fluid. At the same time, fine râles resembling the crepitant râle may be developed during forcible inspiration. This sign is due to the opening of collapsed lung tissue. With the absorption of fluid both signs may again appear for a time. The vesicular respiration undergoes gradual enfeeblement with a sense of increased distance and finally disappears, to be, in some cases, replaced by a bronchial sound of rather metallic character heard during both inspiration and expiration. This is most distinct in the upper and posterior portion of the chest. Loud râles strongly suggesting an excavation may accompany this sign. The occurrence of this bronchial respiration is not yet fully explained, but it is probable, in some cases, at least, that adhesions are the means of transit of the vibrations. The same cause may lead to the presence of vocal fremitus, although its absence is one of the most important physical signs of pleural effusion. Ægophony is not as frequently present as at one time taught, nor is it as characteristic, as it is at times found in

association with cavities or over consolidated lung tissue. Over the cardiac region a pleuro-pericardial friction sound may occur, resulting from involvement of the tongue of lung which partially covers the pericardium. The heart's impulse is enfeebled and its location must often be determined by the area of greatest distinctness.

Complications occur more frequently with left- than with right-sided pleurisy. Endocarditis, for example, is much more frequent. Peritonitis may occur secondarily in septic cases. Nephritis and cerebral abscess are rare. Tuberculosis is called a common sequence, but our modern studies of this subject teach us that in most instances the pleurisy has been the outgrowth of an undiscovered tuberculosis, which in turn becomes active subsequently to the pleuritic attack. Pleurisy is, therefore, a common development in tuberculosis, or rather, a not infrequent phenomenon of that disease. A true primary pleurisy, however, must but rarely be followed by tuberculosis. Among accidents sudden syncope, or even sudden death, has been many times reported. Various things favor a termination of this sort. Such an accident occurring from sudden exertion may be due to cerebral anæmia, which is itself favored by degeneration of the cardiac muscle. Embolism of the brain or lungs secondary to cardiac thrombosis may be the cause in others. The thrombosis is favored by the tardy circulation. Pulmonary embolism is especially dangerous on account of the already seriously crippled condition of one lung. External and internal fistulæ are a common result of improperly treated empyema. The most frequent sites of perforation are in the fifth and sixth intercostal spaces between the nipple and mid-axillary lines; some authors, however, say near to the sternum where the external intercostal muscles are absent. Although I have met perforations many times, only one can be recollected at this point. The long fistulous tracts occasionally met are surprising. Some years since one such was admitted to the Children's Homœopathic Hospital of Pennsylvania, with an opening upon the outer side of the thigh. Amyloid disease of various organs may be a sequence of long-continued suppuration.

Diagnosis.—Of Pleurisy without Fluid Effusion. This form of pleurisy is generally easy of recognition. In association with suggestive symptoms, *a friction sound intensified by pressure of the stethoscope* is sufficient evidence. If the inflammatory changes are located mainly in the region of the heart, pleurisy may be readily mistaken for pericarditis. But in the former the friction sound gradually diminishes and disappears upon holding the breath, whereas the pericardial friction sound is intensified by taking a full inspiration and holding it.

Dry pleurisy may be usually readily separated from intercostal neuralgia if it be kept in mind that in the latter the pain is generally intermitting, confined to one intercostal space, and is marked by sensi-

tive foci (Valleix' pressure points, see page 835, Vol. I). Myalgia with rise of temperature, at times, still more closely resembles pleurisy, but it is recognized by the tenderness and the absence of the friction sound.

Pleurisy with Fluid Effusion. In case of free fluid effusion even inexperienced physical examiners can hardly err. The opposite is true when the quantity of fluid is moderate, *i. e.*, effusions which do not in marked degree dislocate organs or distend the chest walls. This is particularly so if for any reason there is associated with the dulness upon percussion such signs as occur in pulmonary consolidation, *i. e.*, tubular breathing, bronchophony, increased vocal fremitus, etc. Under these circumstances the hypodermic syringe, if properly disinfected, as well as the surface to be punctured, may be used with so little risk of harm and such positive diagnostic results, that there should be no hesitation in its employment. Not only the presence of effusion, but its character, may thus be determined. The ordinary hypodermic syringe will answer, but it is well to select a rather large one, with a needle of more than the ordinary size both in length and in bore. In its use care should be taken not to pump air into the pleural sac, as such air may contain pernicious organisms. Even a puncture of the lung has been shown not to result in harm. A suitable point for puncture is in the fifth or sixth interspace on a line with the centre of the axilla or posteriorly upon the same level. There is no special point which can be looked upon as always superior to all others.

Symptomatic differences between pleurisy with effusion and pneumonia are sufficiently marked, but unfortunately cases are not always typical. The sudden onset, the more marked rigor, the usually more rapid development of dyspnœa, the disturbed pulse-respiration ratio, and especially the rusty sputum of lobar pneumonia, make up a striking and unmistakable clinical picture, but as any of these features may be absent, we cannot rely too much upon symptomatology.

Next to the question as to whether the exudate is purulent or not, the one most frequently propounded is as to the tuberculous or non-tuberculous nature of the pleurisy. As the tubercular nodules in the pleural membranes seldom ulcerate, the tubercle bacillus is not often present in the fluid. This sign cannot, therefore, be depended upon. The family history and a careful survey of the previous health of the patient may be suggestive. The course of the pleurisy, if of tuberculous origin, is apt to be characterized by persistence, with a high grade of hectic fever and steadily diminishing strength and flesh. There is a tendency to relapses and the development of pulmonary lesions. If the pericardium or peritoneum is attacked, or if the remaining pleural sac becomes involved, or the exudate bloody, it is conceded as strong evidence of the tuberculous nature of the affection. Yet it is conceded that pleurisy occurring as an expression of tuberculosis may run a

benign course and terminate favorably. An examination of the fluid with the microscope may show beside the normal constituents of the exudate, blood corpuscles—red and white—crystals of cholesterine, endothelium, etc. Bacteria may be present in septic pleurisies and occasionally cancer cells, when the pleurisy is excited by carcinomatous disease.

Prognosis.—The immediate and ultimate danger to life must both be considered in formulating a prognosis in a case of pleurisy. Undoubtedly the former depends upon the intensity of the attack, which may be generally well determined by the amount of displacement of the heart and other related organs, and much upon the degree of interference with breathing. Notwithstanding most serious symptoms, however, the prognostic statements may be favorable if the nature of the pleurisy is not unfavorable. Even in many of the latter cases, temporary improvement may be secured. Secondary as well as many general pleurisies of apparently primary origin recover, although several months are often required for this result. If the tuberculous nature is undoubted, the outlook is most unfavorable. In empyema healing may be complete, but in this as in all forms of pleurisy, recovery often occurs with some degree of adhesion and impairment of the lung in function and structure. Of structural changes, connective tissue hyperplasia, chronic bronchitis and compensatory emphysema are prominent. The possibility of sudden death has been explained.

Treatment.—Rest in bed and a liquid diet, nourishing but not too bulky in character, are indicated. The active methods of treatment practised until recently by the old school are now quite generally abandoned. General bleeding, leeching, drastic purgation, diaphoretics and counter-irritants, are now declared to be of little or no value.

Early Stage. Aside from the medicines selected, one may consider the application of hot poultices or flannels wrung out in hot water and changed frequently. Some advise the ice-bag, but many patients do not bear it well. It should be used only in the early stages. Best of all applications are adhesive plaster strips, arranged so as to restrain the respiratory movements of the affected side. The strips used should be three inches in width, long enough to encircle the diseased side, and extend a short distance over the sound half of the body. They should be applied just as the patient has finished a complete expiration. It requires the exercise of a little skill to secure the best results from this method.

Later Stages. Little is to be gained from external applications after the stage of effusion is well established, except for the relief of pain, which may still torment the patient. Large effusions may be treated by aspiration. The indications for this procedure are as follows: (1) A degree of distention of the pleural cavity dangerous to life; (2) subsidence of fever and other active symptoms, but no decrease in the

effusion. Left-sided pleurisies on account of the incidental heart displacement require thoracentesis more frequently than do those affecting the right side.

Dangerous symptoms from pressure, occurring at what time they may, demand aspiration, regardless of other conditions present. The indication for its performance is strong if dyspnœa has been rapidly increasing, such rapid increase being indicative of a quickly developing effusion. Under such circumstances the physician should withdraw a portion of the fluid. With the inexperienced the use of the hypodermic syringe should precede the aspiration in order that the diagnosis may be corroborated.

Thoracentesis as performed by the older operators was followed by a large mortality; in fact, the majority of cases died. But since the introduction of the aspirator and the adoption of antiseptic methods, the operation may be performed even under unfavorable circumstances with little risk of unpleasant consequences. Dieulafoy's or some other equally good aspirator should be employed. As a variety of points for puncture have been suggested by competent operators, it is probable that there is no one point which possesses any great advantages over the others. The sixth to the eighth intercostal spaces in the mid-axillary line is a convenient region, and probably a good one to select for ordinary cases. Upon the right side, the liver may be wounded by too low a puncture, this accident having occurred in puncturing as high as the seventh intercostal space. Unusual conditions must have prevailed in cases of this character, or the puncture have been blunderingly made, however. In obese people it is not easy to locate the intercostal spaces, and in them, the mid-axillary line at about a point intersected by a line drawn at right angles from the base of the ensiform cartilage, may be selected as suitable. The hand of the patient should be placed upon the shoulder of the opposite side or upon the head when deciding as to the point of puncture, as this procedure widens the intercostal spaces considerably. Not only should the apparatus employed be rendered surgically clean by means of the best germicidal methods, but the patient's skin and the operator's hands should be treated similarly. Pain can be prevented by the hypodermatic injection at the seat of puncture of a five per cent. solution of cocaine hydrochlorate. If a large trocar is used, and it is best to use one of as large a calibre as can be introduced, the skin may be incised to facilitate its introduction. In order to avoid wounding the intercostal artery, the needle should be introduced at the upper border of the rib. This latter accident is a rare one. It is best to withdraw the fluid slowly and cease the operation promptly, at least for a time, upon the occurrence of cough, dyspnœa, or of faint sensations, however slight. Proper stimulants should always be at hand with which to combat this latter symptom. Ill consequences of this sort

attendant upon thoracentesis are most apt to occur when the exudation has accumulated slowly. Should the canula become obstructed by fibrinous coagula, great care must be exercised that the stilet used to clear it is properly sterilized. The amount of fluid evacuated must depend upon the nature of the case, and the effect of the flow upon the patient. In cases in which the effusion has been rapid, the chest may be entirely emptied without an unpleasant symptom. In protracted cases on the contrary, the drawing off of a moderate quantity may cause alarming consequences. It has been shown that an entire removal of the fluid is often unnecessary, as a partial relief of the intrapleural tension is sufficient to excite activity of the absorbents. This, therefore, is undoubtedly the best plan to pursue in old cases. Under the heading of albuminous expectoration, some authors describe an accident which may occur as a sequence of thoracentesis, and which may terminate fatally. The essential feature is the expectoration of a serous fluid which may amount to even one or two quarts, and which in some instances may be frothy, bloody and attended by dyspnœa, anxiety and cyanosis. Fine râles are heard over the base of the chest. The condition is essentially one of rapidly developing œdema of the lungs due to removal of pressure.

My own experience favors the old teaching of Trousseau, in his remarkable chapter on paracentesis of the chest; *i. e.*, that thoracentesis is more than a palliative treatment, that it is sometimes rapidly curative. I therefore tap in cases of delayed absorption, even if there is an absence of urgent symptoms. In simple sero-fibrinous pleurisy the exudation is generally readily absorbed; puncture is therefore unnecessary in these cases. Thoracentesis is seldom demanded in children excepting for purulent collections. In the old it must often be repeated on account of its frequent occurrence as a secondary affection. My experience accords with that of several recent writers who have found purulent collections in children, so determined by aspiration of a portion of the fluid, disappear without open drainage (resection of a portion of a rib).

Medicinal Agents. Medicines for their specific action upon the inflamed pleura are little used by the dominant school. Most clinicians of this class recommend the free use of opiates from the beginning, with cathartics to secure depletion of blood-serum after the stage of effusion has been established. The former we seldom have need of in properly treated cases, which have received prompt attention, and the latter we prefer to omit in favor of remedies of a specific character. Our most important remedies were recommended by Dr. Wurmb half a century ago. For acute pleurisy of a primary nature, *aconite* is a well-established remedy, and may be administered with much hope of prompt relief. The well-known indications for this medicine are often present. As pleurisy is often seen too late to be successfully treated by aconite, and

as the features indicating it are found in a minority of cases only, we must frequently select other agents. Foremost among these is *bryonia alba;* but its efficacy diminishes with the predominance of liquid effusion. In ordinary plastic pleurisy it is almost specific, whereas in sero-fibrinous pleurisy, after effusion is large, it is almost powerless. *Asclepias tuberosa* is strongly recommended by some observers, the indications being similar to those calling for bryonia.

Cantharis is much more efficient than bryonia in sero-fibrinous exudations, and it is my custom to administer it as soon as the nature of the case is clear, unless there are good reasons for selecting another medicine. The dose seems important. Tincture of cantharides, ten drops in four fluidounces of water, given in teaspoonful doses every one to three hours, is an efficient method of administration. Jousset reports good results from *apis mel.* when cantharis failed to secure absorption of the exudate. In acute general pleurisy occurring in rheumatic or gouty individuals, *colchicum*, or better, *colchicine*, is a powerful remedy. Of the latter, the third decimal trituration should be repeated every one to two hours.

Arsenic may be considered if in spite of cantharis the effusion increases and dyspnœa, cyanosis and a restless anxiety supervene. Even in progressive liquid exudation I have observed good results from *sulphur*, a remedy which is generally reserved for cases of dry pleurisy. Wurmb, and many since his time, have earnestly recommended *hepar sulphur* for persistent plastic pleurisy. Prescribing largely on etiological grounds, *arnica* has been advised for pleurisy developed after injuries, and *rhus toxicodendron* when the attack has followed upon exposure to cold and damp, as from a wetting while heated. My experience has been rather favorable with both of these remedies.

In the dry pleurisies attendant upon pneumonia and phthisis, *bryonia* and *kali carbonicum* are universally esteemed. *Ferrum phos.* and *squilla* should also be considered. *Scillitin* has appeared to me as more efficient than squills. I have used the second decimal trituration. Pleurisies associated with Bright's disease and other affections marked by blood changes are best treated by *arsenic*, *cantharis* and *mercurius corrosivus.* For the acute pleurisy attendant upon pneumonic fever, I have repeatedly observed good results from *phosphorus* after the failure of bryonia and other medicines.

Purulent collections are little influenced by medicines, but after removal of the pus, much may be accomplished by the careful use of *silicea, sulphur, mercurius, hepar sulphur, arsenite of quinine*, and especially by the *iodide of arsenic.* Of the latter drug two grains of the second decimal trituration should be given every few hours.

Eklund, of Stockholm, in which cold changeable climate pleurisy is a common disease, strongly advocates "capillary drainage" secured

by enveloping the chest in a thick layer of warm cotton-wool followed by a four-fold layer of woolen cloth. He claims that the long tubular hairs form a porous substance with great power of absorption. The application is to be renewed night and morning, the patient to remain constantly in a warm bed and to have the interrupted cutaneous function restored by moving the bowels with a warm infusion of senna leaves. This observer claims to have completely prevented free exudations by this method. His observations are interesting, but appear hyper-enthusiastic.

The local treatment of purulent pleurisy is strictly surgical. For full instructions the reader is referred to surgical works. The results obtainable may be somewhat prejudged by the nature of the micro-organisms present in the fluid. The pneumococcus pleurisies are the most favorable, this organism having little pyogenic or destructive power. Very different are those associated with streptococci and staphylococci, which are destructive. Pleurisies of pneumococcal or tuberculous origin are often complicated by the grafting of these organisms. Cases of such character require as a rule free drainage and antiseptic irrigations of the pleural sac. Resection of a portion of one or two ribs is much practised in order to furnish an opening of such size as to avoid closure from rapid contraction. For the cleansing of the cavity, peroxide of hydrogen in various strengths and many of the well-known germicidal solutions are employed.

CHRONIC PLEURISY.

Chronic pleurisy presents the same types as the acute form of the disease. Thus we recognize a chronic dry, and a chronic sero-fibrinous pleurisy, and empyema. The first-named may appear as a continuation of the acute form, or it may be a primary disorder—"primitive dry pleurisy." In the first case the effusion is absorbed and the pleural surfaces become agglutinated. The fibrinous exudate undergoes organization, connective tissue prolongations extend into the lung substance. The chest walls retract and expansion of the lung is prevented. Sometimes the adhesions and organization of the exudate take place in foci, forming limited adhesions between which a fluid effusion is found, the condition thus resembling a cystic formation. In most cases these processes occur about the bases of the lungs. In young subjects, ultimate recovery may take place, the lung resuming its normal functions and retraction of the chest walls disappearing.

Primitive dry pleurisy has been ably studied by that great clinician, Sir Andrew Clark, who recognized three types: (1) One in which there exist uncomplicated adhesions between the pleural surfaces, these adhesions being either local or general. When of recent origin, it gives rise to discomfort on deep breathing and uneasy dragging pains in the

chest. With the long continuance of the disorder, these symptoms disappear, physical signs even being wanting. (2) A tuberculous variety which accompanies chronic pulmonary tuberculosis. It is rarely absent as a complication of the latter disorder. It is especially apt to involve the pleuræ about the pulmonary apices, causing extensive adhesions and thickening at the diseased points. Sometimes this form of tuberculous dry pleurisy is strictly primary, the lesions being first manifested in the pleural membranes, later extending into the pulmonary substance. It is, however, a rare affection. (3) A form of dry pleurisy of very rare occurrence, characterized by great thickening of the involved membranes, and occurring for the most part in persons of middle age and beyond. No symptoms are discernible early in its course; later, nutrition fails, and the case is complicated by intercurrent attacks of bronchitis; finally chronic bronchitis becomes a permanent condition and may be associated with bronchiectasis. Dyspnœa is the most prominent symptom. The urine is almost always slightly albuminous.

Physical examination in all these cases reveals friction sounds in the early stage, and later, if extensive adhesions are present, the respiratory movements are limited; the vesicular breathing is usually rather feeble, or it may manifest broncho-vesicular characteristics. The percussion dulness is increased in proportion to the amount of thickening of the pleuræ and fibroid changes in the lungs. Considerable alteration is necessary to develop a clearly peceptible dulness.

Sero-fibrinous pleurisy, like the plastic form, may be a chronic affection from the outset, creeping on so insidiously that it is a matter of surprise when exploration demonstrates the presence of fluid. Flint states that "in the great majority of cases, chronic pleuritis is a subacute affection from the first." The causes, anatomical changes, exudate, etc., are the same as in the acute variety; but in the chronic disorder as compared with the acute, the serous exudate predominates over the fibrinous element. The exudate may continue for months without undergoing purulent transformation. Bilateral chronic pleurisy is usually associated with tuberculosis of the lungs.

The clinical course of the disorder is such as to readily deceive those who do not make routine use of methods of physical examination. Pain may be slight or absent; it is never severe. Cough is not a prominent phenomenon. Respirations are increased in proportion to the quantity of the exudate. The patient is usually quite comfortable while sitting, but mild exercise produces a marked shortness of breath. The pulse is increased in frequency to from 90 to 120 per minute. It is rather small and weak. The surface of the body may give evidence of feeble capillary circulation. There may be slight chills at irregular intervals, and sweats are common. They are usually nocturnal, and not necessar-

ily related to the febrile exacerbations. The patient's general health is poor; there may or may not be evidences of anæmia, dyspepsia, constipation, diarrhœa, and emaciation. The subject of chronic pleurisy often continues his usual avocation in ignorance of the serious condition present. Such patients often present themselves at the out-patient departments of our hospitals for treatment. Pericarditis may be associated and add its influence to oppress the circulation. The disease has a tendency to recovery under proper treatment, unless it happens to be associated with some serious underlying condition, such as phthisis. The resulting contraction of the chest is often associated in an etiological way with a lateral curvature of the spine, but neither is a symptom which causes much annoyance. The heart may be permanently displaced to the right in left-sided pleurisies owing to the formation of adhesions. As in the acute form, chronic pleurisy is quite frequently succeeded by phthisis. Modern teaching upon this point states that pleurisy does not especially predispose to phthisis, but that phthisical disease of the lung usually precedes the pleurisy and is simply accelerated by the latter.

For the treatment of chronic pleurisy the reader is referred to the remarks on the treatment of the acute affection. (See page 318.)

HYDROTHORAX.

Hydrothorax is probably always a secondary affection, reports of cases in which it is dissociated with a well-defined primary disorder being rare. It consists of a non-inflammatory liquid effusion into one or both pleural cavities, and may develop in the course of any chronic affection which has a hydræmic tendency, such as Bright's disease in its various forms, carcinomatous and cachectic conditions, etc. It occurs most commonly in association with general dropsies, whether such originate in functional or organic diseases. Fraentzel has seen it complicate general dropsy associated with no discoverable pathological condition, and after scarlatina in which nephritis was absent. Hydrothorax usually appears late in the course of most cases of aggravated general dropsy dependent upon organic heart and kidney disease. Sometimes it arises from local causes, as tumors, so situated as to interfere with the circulation in the veins of the pleuræ.

Pathology and Morbid Anatomy.—Being due, as a rule, to a general cause, hydrothorax is usually bilateral, although in the majority of cases one pleural sac contains more fluid than does the other. When arising from cardiac disease, one side of the chest is often affected alone, or if both are involved the effusion on one side is far in excess of the other. Unilateral hydrothorax occurs when the trouble is caused by the pressure of an intrathoracic tumor, and when a previous pleurisy has caused such extensive adhesions as to obliterate the pleural cavity on that side.

The transudation is of a yellowish color and clear, consisting of water with albumin and blood salts. There is an absence of fibrinous flakes as well as of fibrinous matter adherent to the pleura. This membrane is dull, opaque and somewhat puffy, owing to effusion into the subserous tissue. Sometimes the effusion is encapsulated, owing to old pleuritic adhesions. A degree of compression of the lungs dependent upon the amount of accumulated fluid takes place. The effusion ranges in quantity from a few ounces to many pints; the quantity, however, is seldom very large. The seriousness of the symptoms in hydrothorax depends upon the fact that both sides of the chest are generally involved.

Symptomatology.—The symptoms present depend, first, upon the primary disorder, and secondly upon the lung compression. Their development is insidious. The most prominent feature is dyspnœa, which gradually increases in intensity, until, in aggravated cases, the distress is terrible. It usually exists in direct proportion to the extent of the effusion. In the early stage it amounts to a slight shortness of breath, increased by exertion; late in the course of the disease the patient is obliged to maintain the erect posture, and cyanosis, cold clammy sweat, anxiety and distress are prominent. Speech is interfered with in severe cases, the patient being able to speak only in broken sentences.

Negative conditions are of value from a diagnostic standpoint. Fever is absent; pain is not often experienced; cough is not always present and when associated with expectoration, the latter is thin and watery, occasionally frothy.

Physical Signs.—These are the same as those already detailed for pleurisy with effusion, with the difference that pleuritic friction sounds are absent. The displacement of adjacent viscera is not as marked as in acute pleurisy with the same amount of effusion, because both sides are involved, and downward pressure is antagonized by the abdominal dropsy which is nearly always associated with the hydrothorax.

Diagnosis.—The diagnosis should usually be made without difficulty. An accumulation of fluid in both pleural cavities, without the presence of symptoms indicative of an inflammatory affection, but associated with evidences of heart, kidney or other disease known to be a common antecedent of hydrothorax, should, in association with the physical signs, make the nature of the case clear. The physical signs, as already stated, are similar to but not identical with those of pleurisy with effusion. The intercostal spaces are not as much distended as in pleurisy, owing to the absence of inflammatory changes in the parietes of the chest. The effusion follows the law of gravity more readily than in the case of pleurisy.

Prognosis.—This depends upon the nature and stage of the underlying affection. So far as the hydrothorax is concerned, it is often

possible, if other conditions are favorable, to remove it entirely; but as in most instances it is associated with incurable organic affections, the accumulation is likely to return even if completely removed. It is often the immediate cause of death in the disease it complicates. Sometimes it runs a rapid course, tending to a fatal issue within a few days.

Treatment.—On account of the strong tendency to recurrence, it is inadvisable to perform aspiration unless immediate relief is demanded. So clearly is this condition associated with the primary affection, that the treatment must depend upon the nature of the cause, and as this can be but seldom removed, the affection is practically incurable in the majority of cases. It is well to limit the amount of fluids taken. Sometimes the effusion can be lessened by the administration of saline purges, but because of the exhausting effects of such medication, it must be resorted to with great discrimination.

Medicines especially adapted to this condition are *arsenicum, apocynum, apis, digitalis* (best given in the form of effusion), and *sulphur.*

PNEUMOTHORAX; HYDROPNEUMOTHORAX; PYOPNEUMOTHORAX.

The rare condition of entrance of air into the pleural sac is known as pneumothorax. This accident is quickly followed by inflammation and effusion (hydropneumothorax). When the inflammation is suppurative, the effusion is purulent (pyopneumothorax).

Etiology.—The common cause of pneumothorax is undoubtedly rupture of a softened focus or of a cavity during the course of pulmonary phthisis. This view was originally taught by Laennec and has been corroborated by Fraentzel, Grisolle, Walshe, Fuller and Fernet. According to Niemeyer, the accident is especially liable to occur in rapid cases of pulmonary tuberculosis, a view with which Fraentzel is not in accord. It certainly is of less frequent occurrence during the course of fibroid phthisis. It may also occur from perforation of the pleura during the course of gangrene of the lung, pulmonary hydatids, and hæmorrhagic foci. The pleural sac may be also opened in cancer of the œsophagus or through the diaphragm in cancer or ulceration of the stomach. It has been known to follow the perforation of an abscess of the liver, which opened at the same time into one of the hollow abdominal organs. Traumatism may occasion pneumothorax. Thus it has followed perforating wounds of the chest, even such as result from the use of the needle of the hypodermic syringe. The lung itself may be ruptured by a blow which inflicts no damage whatever on the thoracic walls. Fracture of the ribs is said to very rarely excite it, even if the lung has been lacerated by the injury. Violent paroxysms of cough in pertussis, and unusual muscular strain, have produced some few cases.

Abscess of the bronchial glands, septic broncho-pneumonia, and empyema may also cause pneumothorax.

Pathology and Morbid Anatomy.—The air in the pleural cavity in pneumothorax follows upon perforation of the pleural layers. The idea of the possibility of that membrane secreting air or gas is no longer admissible. That the gas may arise from the decomposition of exudations is doubtful, for in order that such decomposition may take place, the pre-existence of air is necessary.

The morbid changes consequent upon a pneumothorax are pleural effusion with a sero-fibrinous or purulent exudate and displacement of the surrounding organs. The lung on the affected side is compressed, often to the extent of being rendered atelectatic and pushed backward against the spinal column. The diaphragm is depressed, and with it the liver and spleen. If upon the left side, the mediastinum and the heart are carried to the right. The introduction of a perforated needle after death, or the use of the aspirator during life, demonstrates the presence of gas, which is found to consist mainly of carbonic acid and nitrogen. The affected side may be greatly distended. The relative proportions of fluid and gas vary greatly. Should the lungs be confined to the costal walls by old adhesions, it cannot, of course, suffer so much compression. In recent cases the opening into the lung is usually quite small. Should it be impossible to discover it by ordinary inspection, the lung may be inflated under water, when, if the opening is still pervious, it may be detected by the bubbles of air which will be emitted. After the continuation of a pyopneumothorax for some time the accumulated fluid may find its way into a bronchial tube by means of ulceration and be expectorated. It may also, as in empyema, perforate the tissues in any direction.

Clinical History.—While according to West and others, pneumothorax may occur and remain latent, perhaps being first discovered post-mortem, it is usually inaugurated by severe if not alarming symptoms. The rapidity of development of urgent symptoms depends upon whether the opening is large enough to permit the expiration of a large portion or all of the air inspired. If little of the inspired air finds its exit during the succeeding expiration, which is often the case owing to the valve-like action of the opening, the pleural sac rapidly fills and the most aggravated symptoms are developed at once. If, however, the accumulation of air is slow, the growth of symptoms will correspond. In some cases there is at the time of the rupture a sensation as of something giving away, accompanied by pain in the upper part of the chest or in the back. This is followed by dyspnœa, which may be urgent or slight, pain in the side, faintness, and evidences of obstructed respiration and circulation. The voice may be weak, even aphonic. The dyspnœa is not apt to be so great when the escape of air is lessened by previous pleural

adhesions. At first there is no rise of temperature; there may even be a fall; respirations become frequent. Later, when pleuritis supervenes, fever develops. The patient usually desires the upright position and prefers to lie upon the affected side. If the condition does not soon terminate fatally, the symptoms of effusion are added to those of the simple presence of air.

Death may occur within a very few hours, owing to obstructed respiration and collapse; or, life may continue for weeks, when the collapsic condition disappears, the patient's general state improves somewhat, but the developing effusion increases rapidly. All the symptoms are now aggravated, and the patient finally dies, usually from pulmonary œdema, imperfect oxygenation of the blood, or the consequences of the large amount of fluid exudate. In a few cases the disease may continue for several years, the patient in the meantime being able to pass a not too uncomfortable existence. Such a course was pursued by a case of which I have knowledge for over four years.

Physical Signs.—Inspection. Limited motion and distention of the chest upon one side, with effacement of the intercostal spaces, are apparent at a glance, and if upon the left side, the pulsation of the heart is in a new position to the right of the normal. The intercostal distention is especially noticeable when the pulmonary opening is large and there is free ingress of air into the pleura during the respiratory movements. These symptoms are apt to develop suddenly, and are especially significant when occurring during the course of phthisis, the patient having hitherto been comparatively comfortable.

Palpation. Unless previous adhesions are present, vocal fremitus is absent and the heart, liver, and spleen are displaced.

Percussion yields a clearly tympanitic sound down to the upper level of the effusion, which level may be altered by changing the position of the patient. The quality of this tympanitic sound will vary according to the tension of the contained air, the degree of compression of the lung, and whether or not there is an opening into a bronchus. Over the fluid there is, of course, flatness. The tympanitic resonance may be absent if the distention of the chest is sufficient to prevent distinct vibrations; the sound is then dull and muffled.

Auscultation. There is always an absence of the vesicular respiration and of vocal sounds over the region occupied by the fluid. Over the air area the inspiration may be heard apparently much removed from the ear, feeble, and with a metallic or amphoric sound. The same metallic quality may be present in the voice, the râles, and in the so-called "metallic tinkling." This is produced variously,—by the dropping of fluid on the surface of the accumulation, also by speaking, coughing, shaking the body, or in various ways agitating the fluid and the gas. If the body be shaken while the ear is near or in contact with the chest,

a splashing sound which has a metallic quality is produced. This sign is as old as the Hippocratic age. Auscultatory percussion performed after the method suggested by Trousseau is of great value. A coin is placed flat upon the chest and is struck with another coin, the ear of the auscultator being placed over the air space. A ringing sound of metallic quality is produced.

Diagnosis.—When acquainted with the history of the patient, the diagnosis is not usually difficult, if the examiner is reasonably expert in physical examinations. Simple pleurisy with effusion, emphysema, obstruction of a large bronchus, diaphragmatic hernia, and large superficial pulmonary cavities, are conditions which are generally rated as presenting resemblances to pneumothorax. It seems hardly possible that emphysema can present a sufficient resemblance to pneumothorax to lead one at all acquainted with physical exploration astray. The history of slow onset must show at once that the condition is not pneumothorax. Emphysema is a bilateral affection, resonance is not tympanitic as in pneumothorax, the enlargement of the chest is more particularly manifested in the clavicular regions, and the normal vesicular murmur is never entirely destroyed. When percussion gives a dull note, as it may do when the intrapleural tension is great, the resemblance to pleurisy is considerable. But the coin test affords a ready means of differentiation. Sometimes a diagnosis seems impossible without withdrawing fluid, when a tympanitic note will develop. Large cavities present many features of resemblance to pneumothorax, but there is no displacement of the heart or other organs, the chest walls are not distended; on the contrary, they are retracted, the lesion is in the upper portion of the lungs, and the coin test gives negative results.

Prognosis.—The prognosis will depend largely upon the cause of the disease. If occurring in an apparently healthy individual, considerable hope of recovery may be given. If phthisical, the patient has but little chance of recovery, although several instances of apparent retardation of the lung disease due to pneumothorax, have been observed. The average duration of life in phthisical cases is but a few days. Recoveries have been reported when the pneumothorax has developed during the early stage of phthisis. If the patient outlives the early fatal days, the hope of recovery increases with each additional day of life. If the perforation of the pleura heals, the air is absorbed, and the condition is then one of sero-fibrinous or purulent pleurisy. We are suspicious of the reported cases of pneumothorax without the development of sequential pleurisy. Pleurisy is due to the germ-laden air, and it must be rare indeed that an aseptic atmosphere is admitted into the pleural cavity.

Treatment.—The disease must be treated much as recommended for acute pleurisy. If the quantity of fluid is large, aspiration may be

practised with benefit, and if the collection is purulent, thorough drainage must be effected. Air under tension must be evacuated. Hot water applied to the affected side will relieve the pain. Sometimes morphia may be deemed necessary for this purpose. As all of these measures, as well as the medicinal and general treatment, have been fully dealt with in the article on acute pleurisy, it is only necessary to refer to those pages on which they have been elaborated.

HÆMOTHORAX.

Definition.—An accumulation of blood in the pleural cavity occurring independently of inflammation of the lining membrane.

Etiology.—The causes of hæmothorax are, first, mechanical injuries; and secondly, pathological processes leading to rupture of bloodvessels. The former needs no explanation here. Among the latter are to be mentioned the bursting of an aneurism, hæmorrhage from the lungs into the pleura, erosion of bloodvessels by cancer, and tuberculosis.

The effused blood soon undergoes coagulation, and may either produce local inflammation and rapid death, or be eventually entirely absorbed.

Symptomatology.—The symptoms are those of internal hæmorrhage, providing the amount of blood effused is large, to which the phenomena of pulmonary compression are added. Dyspnœa is the principal among the latter symptoms. Pain may be present. Inasmuch as the vascular injury producing the hæmorrhage is in the lung tissue, air often escapes with the blood into the pleura. This not infrequently leads to suppurative manifestations.

Diagnosis.—Hæmothorax is recognized by the signs of pleural effusion following rapidly upon injury without evidences of pleuritis, or in association with the signs of aneurism or malignant intrathoracic disease.

Prognosis.—The prognosis is unfavorable. When the result of rupture of aneurism, death follows very shortly. When due to traumatism, the prognosis is decidedly more favorable. Hæmo-pneumothorax offers a very unfavorable prognosis.

Treatment.—When the hæmorrhage starts, attempts may be made to stop the flow by applications of ice to the chest and between the scapulæ. The patient must be kept in bed and absolutely quiet. When the effusion is large, it may be removed, if possible, by aspiration.

Diseases of the Urinary System.

A description of the diseases of the urinary system includes a consideration of affections of the kidneys, their pelves and ureters. Diseases of the bladder and of the associated glandular body—the prostate gland—and of the urethra, are by common consent relegated to surgical works or special treatises, and but few of them are noticed in this section.

Anatomical and Physiological Data.—Location. The kidneys are situated in the lumbar region, one upon each side of the spinal column. They are deeply placed behind the peritoneum and rest posteriorly upon the lumbar portion of the diaphragm and upon the quadratus lumborum muscle. The left kidney is a little higher than the right one. Their upper extremities correspond to the twelfth dorsal, and their lower extremities to the lower border of the second or some portion of the third lumbar vertebra. The upper extremities are a little nearer the spinal column than the lower. About one half of each organ is covered by the lower ribs. The outer border of each kidney is quite accurately outlined by the external margin of the sacro-spinalis muscle. The front of the organ is covered on the right by the ascending and on the left by the descending colon; its shape is ovoid, and sometimes called "bean-shaped." The upper extremity is the larger and more rounded. The organ is flattened in its entire length antero-posteriorly, but more conspicuously so in its lower third. The outer border is convex, the inner one concave and contains a longitudinal fissure. In this fissure —the hilum—rest the several vessels, viz., the renal artery, renal vein and the ureter. The hilum communicates with the depression in the kidney called the sinus, through which the vessels pass to the organ. The weight is about five and one-half ounces in men and a half ounce less in women.

Size. The length of the kidneys is from four to four and one-half inches, the breadth is about half the length and the thickness about half the breadth. The capsule is a tough, thin, fibrous membrane, which by extension forms the outer coat of the ureter. It is attached to the organ by bloodvessels and delicate connective tissue. Beneath it there is a layer of muscular fibres of the non-striated variety. Upon the right side the suprarenal capsule is in close relation with the liver, and upon the left with the spleen. One kidney may be absent or the

two organs may be united by a band of renal tissue (horse-shoe kidney). Malpositions are not rare.

Physical Examination of the Kidneys yields unsatisfactory results. The healthy organ, associated with normal body conditions, cannot be detected by means of palpation; but a much enlarged organ, due to new growths of the organ itself, or of the perirenal structure, or a distention of the pelvis, especially in thin persons with lax abdominal walls, may be detected by bimanual examination, if the shoulders are raised and thighs flexed upon the abdomen. Under these conditions one hand should be placed in the lumbar region and the other pressed deeply into the hypochondrium. Position upon one side or upon the anterior surface of the body is sometimes preferable. New growths of the kidney, distentions of the pelvis from accumulated fluid, and misplaced organs, are generally detectable by this method.

Percussion may be employed for determining the boundaries of the kidneys, but the results are not satisfactory, owing to the covering of bone and thick lumbar muscles. Palpation is more successful and is favored by thin sacro-spinalis muscles. The renal region is often tender upon pressure in acute nephritis, stone in the kidney, tumor of the kidney, hydronephrosis, and in marked degree in extra-renal inflammatory processes. In tumor of the kidney the enlarged organ may be palpated *in situ*, or it may leave its moorings and constitute a movable or "floating kidney." The diagnosis is more difficult than that of the simple uncomplicated movable kidney, as the shape of the organ is often altered by the growth, the kidney losing its bean shape. Absence of respiratory movements in the tumor, and the ability to replace the organ, is most important evidence of the renal nature of the growth.

The subject of examination of the bladder is considered in works upon surgery, but it may be stated concisely that the bladder, if distended, may be detected by palpation as a rounded tumor above the pubis and the diagnosis confirmed by percussion and the use of the catheter. Abnormal sensitiveness and thickening of the ureters (some say the normal ureters) may be felt in the vaginal fornix, and through the anterior vaginal wall. Such changes may attend a general catarrh of the bladder and pelves of the kidneys, changes in the ureters secondary to a calculus pyelitis, or tuberculous disease of the kidneys.

Function of the Kidneys.—The function of the kidneys is the separation from the blood of certain solid matters in watery solution, added to which there are the products of the mucous membrane, whether this surface is in a normal or an abnormal condition. Failure of the kidneys to properly perform this function results in the retention of irritating substances which exert a deleterious influence upon the blood, organs of circulation, nervous structures, and, less prominently, upon the mucous and serous membranes and other tissues and organs.

The urine within its normal range presents a marked variation in the amount of its constituents. Such fluctuations are greatly increased by disease, and in many affections abnormal elements are added, *e.g.*, in Bright's disease, albumin; in diabetes, sugar; in jaundice, bile. Abnormality in the constituents of the urine is largely dependent upon certain general constructive and destructive processes and altered functional activity of the higher organs; also upon morbid changes in the kidneys, with a resulting impairment of their power of excretion, and the addition of products foreign to the urine resulting from pathological changes in the urinary apparatus. Impairment of the renal function resulting from disease of the kidneys, preventing in some degree the elimination of excrementitious products from the blood, results in an overloading of this fluid with substances most of which exert an injurious influence upon the tissues, thus exciting a variety of symptoms, the character of which will be dependent upon the parts especially attacked. The clinical picture of diseases of the kidneys being made up largely of phenomena having such an origin, it follows that quite a percentage of the symptoms attendant upon renal disease are not immediately related to the kidneys. These groups of symptoms may be, indeed often are, the first to direct the patient's attention to the fact that he is not in good health.

THE EXAMINATION OF THE URINE.

Examination of the urine should constitute a routine measure in investigating any and every case of disease. The reason for this positive and sweeping statement is apparent to every physician of experience. Unfortunately, the time at the disposal of the busy practitioner is such as to make him negligent in this respect. Even when he undertakes a urinary analysis, he generally does so in an incomplete way, possibly being satisfied with determining the specific gravity of the urine and the presence or absence of albumin and sugar. He who confines himself to such inadequate methods deprives himself of very important clinical information. It is not contended that the urine is an infallible index of disease, but it is certain that searching analyses of this fluid will often give information not otherwise obtainable, even in diseases in which the urinary organs are sound.

The Preparation of the Specimen.—Patients must be instructed as to the care necessary in obtaining the desired specimen of urine. In all cases it is important that a mixture of all the urine passed during the course of twenty-four consecutive hours shall be furnished. It must be passed into a thoroughly clean vessel, which has not been wiped by a towel after scouring and rinsing, and which should be kept covered during the period of collection. About four ounces of the urine should be poured into a bottle known to be absolutely clean. The

patient should also be instructed to measure accurately the quantity of urine passed in the twenty-four hours.

Reaction of the Urine.—This varies during the twenty-four hours, although a collection of urine for this period of time is acid in reaction, owing to the contained acid phosphates and urates. Under ordinary diet there is often a transitory alkalinity about one or two hours after a full meal, supposed to be due to alkaline salts in the blood. The view which attributes this reaction to the development of hydrochloric acid in the stomach lacks confirmation. The urine may also be rendered alkaline by a vegetable diet, by hot baths and free perspiration, also by the administration of alkaline carbonates. In alkaline or neutral urine, separation of the phosphates occurs and quickly leads to cloudiness and the deposit of a sediment, which clears at once on the addition of a small quantity of acetic or nitric acid. Alkaline urine may be persistently present, especially in chronic affections of the mucous surface of the urinary organs, also in some persons of feeble nutritive powers. The precipitated earthy phosphates do not adhere and form calculi unless the reaction is due to ammonia, in which case the triple phosphates of ammonium and magnesium unite with them, resulting in a concretion of mixed phosphates. An acid reaction is favored by muscular exercise, an animal diet and the administration of acids. Excessive acidity occurs in persons suffering from fever, in acute affections such as rheumatic fever, and in some chronic affections, notably in lithæmia. It is often found after excessive eating and a failure to take sufficient water. Such concentrated acid urine is irritating to the urinary apparatus, leading to frequent urination and to chronic affections of these organs, being also a cause of persistent urethral discharge after gonorrhœa.

The chemical reaction of the urine is determined by the use of litmus paper. Blue litmus paper turns red under the influence of an acid; and red paper becomes blue in the presence of an alkali. It is more convenient, however, to have a neutral paper which has somewhat of a purple color, and which changes to red or blue according to the chemical reaction of the urine under examination.

In the case of persistently alkaline urine, it is always well to determine whether that reaction is due to the presence of a fixed or volatile alkali. The former occurs by reason of one of the conditions mentioned above; the latter because of inflammation of the bladder or some other portion of the lower urinary tract. In the case of the volatile alkali, the blue litmus paper returns to its former color after drying.

Quantity of Urine Passed in the Twenty-four Hours.—The average daily quantity of urine is placed at three pints, or nearly fifty ounces. Departures from this figure may occur under certain circumstances and be consistent with health. It is increased by drinking large quantity of fluids, and is lessened by exercise and free perspiration.

In disease the quantity of urine is increased in diabetes mellitus, interstitial nephritis and hysteria. It is decreased in some renal diseases, cirrhosis of the liver and in acute infectious fevers and inflammatory affections generally.

Color of the Urine.—The normal color of the urine is usually described as amber or straw-colored. Departures from this standard are observed in health according to the degree of urinary concentration. After partaking of large quantities of fluid the urine may become almost as colorless as water. Causes which lessen the quantity of urine excreted serve, as a rule, to deepen its color. Exceptions to this statement are observed in disease, for high color is sometimes observed in association with increased quantity.

As the result of disease, alterations in color are observed. Thus the urine is pale in diabetes and hysteria and after convulsions, and is high-colored in fevers. Alterations in color are observed as the result of the presence of abnormal coloring matters, especially those derived from the bile and the blood. Concerning the normal and abnormal pigments of the urine more will be said when speaking of the various tests for their presence.

Specific Gravity of the Urine.—The determination of the specific gravity is important, as by it we learn in a general way the amount of solids contained in the urine. The specific gravity in health is from 1018 to 1022, the normal ranging from 1015 to 1025. The ingestion of large quantities of fluid may reduce it temporarily to 1010 or lower. Free perspiration and abstinence from fluid may increase it to 1030.

The specific gravity of the urine is determined by an instrument known as the urinometer, which is constructed on the principle of the hydrometer. A cylindrical glass vessel is furnished with the instrument, which is filled to about three-fourths of its height with the urine to be tested. The urinometer is then introduced, and the point on its stem at the level of the urine marks the specific gravity. Care should be taken that the urinometer is not in contact with the walls of the receiving vessel.

Unfortunately, however, urinometers are often inaccurate instruments. One accompanied by a certificate should always be purchased. A source of error arises from the fact that most of them are graduated for the estimation of the specific gravity of fluids at a temperature of 60° F. Very often they are used for urine freshly passed, which must have a temperature of over 90° F. Every seven degrees of temperature above that for which the instrument is standardized calls for the addition of one degree of gravity over the reading of the instrument.

The proportion of solids in a given specimen of urine may readily be determined by multiplying the last two figures of the specific gravity by Haeser's coefficient (2.33). The result will indicate the number of

parts of solids in one thousand parts of urine. Thus if the specific gravity is 1020, to determine the proportion of solids we multiply the last two figures (20) by 2.33; the result is 46.60, which represents the proportion of solids in one thousand of urine.

An abnormally low specific gravity is observed in cases in which renal excretion is deficient, hence in some forms of organic disease of the kidney; it is often low in states of imperfect nutrition, in hysteria, and from high tension of the arteries from any cause. A high specific gravity is observed in diabetes, any figure over 1030 being strongly suggestive of the presence of sugar in the urine.

Urea.—Of the constituents held in solution by the urine, urea $CO(NH_2)_2$ is the most important. It is the product of nitrogenous waste, and is so freely soluble that it does not precipitate even from highly concentrated urines. The amount excreted in twenty-four hours ranges from 30 to 40 grammes (from 450 to 600 grains), according to the diet and weight of the individual. It is equal in amount to all the other urinary solids combined. It increases with the amount of albuminous or nitrogenous food ingested, and is but little affected by exertion. Urea gradually crystallizes from concentrated urine, assuming the form of quadratic prisms with bevelled extremities. If nitric acid is added to urine which has been evaporated to the consistency of mucilage, the nitrate of urea will appear mainly as rhombic plates. Estimates of the quantity of urea excreted in the twenty-four hours are of the highest clinical importance as affording the only reliable guide to the manner in which the kidneys are performing their work. The most convenient method for general clinical use is based on the decomposition of urea by sodium hypobromite with the evolution of nitrogen gas. This is best practised by means of the little apparatus known as Doremus's ureometer (see Fig. 25), the accompanying cut of which is self-explanatory.

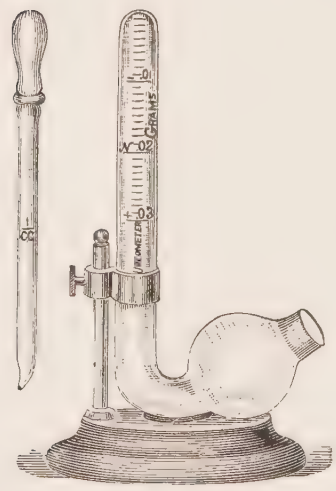


Fig. 25.—Doremus's Ureometer.

The hypobromite solution is prepared as follows: A solution of sodium hydrate is made of the strength of one ounce to one pint of distilled water and preserved in a bottle with a rubber stopper. To ten volumes of this solution add one volume of bromine and dilute with ten volumes of water. The test solution thus prepared does not keep well, and should not be used when over two weeks old. It is always well, therefore, to prepare it in small quantities. A little care is required in handling bromine with comfort. Immediately on removing the stopper

from a fresh bottle the bromine should be covered with water, which prevents unpleasant escape of fumes when the stopper is removed and also rapid loss by reason of its great volatility. To remove a portion it is only necessary to insert a graduated pipette and take up the desired quantity.

To use the Doremus ureometer, the long arm of the instrument is completely filled with the hypobromite solution. One cubic centimetre of urine is then passed into the same by means of a graduated pipette furnished with the instrument. Care must be taken that the urine is expelled slowly and that all of it passes into the long arm of the ureometer. Immediately upon the mixture of the two fluids nitrogen is evolved from the decomposing urea and accumulates at the top of the tube, which is graduated, the marks indicating the percentage of urea in the sample tested. To be of value, observations of the quantity of urea should be made upon specimens of urine from a twenty-four hours' collection. In the purchase of a ureometer the accompanying pipette must be carefully selected, as some of them are so constructed as to make the discharge of urine into the long arm of the ureometer a matter of great difficulty. The estimation of the percentage of urea by this method is as readily made as are the ordinary tests for the presence or absence of albumin and sugar.

Fowler's method of quantitative estimation of urea is based on the decomposition of that substance by liquor sodæ chloratæ. Here, however, the result is calculated from the loss of specific gravity in the mixed fluids by the decomposition of the urea. A great objection to the method is the very accurate urinometer required. The first procedure is to take the exact specific gravity of the urine to be examined and of the liquor sodæ chloratæ. One ounce of the urine is then mixed with seven fluid ounces of the soda preparation. Decomposition of urea takes place immediately with brisk effervescence. When this has subsided completely, the specific gravity of the fluid is taken. We are now prepared to use the result for estimating the quantity of urea. First calculate the specific gravity of the mixture; say the specific gravity of the urine is 1818; of the sodæ chloratæ, 1024. Of the former but one volume was taken, of the latter seven. 1024 is to be multiplied by 7, the result of which is 7168. Add to this 1018, the specific gravity of the urine, and we get 8166. Divide this by 8 and we obtain the mean specific gravity of the mixture, 1023 before decomposition. From this subtract the specific gravity after decomposition and the result is 4. This is to be multiplied by 0.77, which gives 3.08 as the percentage of urea.

The Importance of a Quantitative Estimation of Urea. The quantity of urea eliminated is a pretty good index of the excretory power of the kidneys and of the extent of nitrogenous waste in the system. In the various forms of Bright's disease the urea elimination is

diminished. It is also found lessened in renal affections in which the urine affords no other index of disease. In the acute febrile and inflammatory diseases prior to their crises, owing to the great tissue waste, the urea is greatly increased. After that time, as repair takes place, it is diminished. The quantity of urea eliminated should be nearly or quite four grains for each pound of weight.

Uric Acid ($C_5H_4N_4O_3$).—Uric acid, like urea, is a product of the metabolism of nitrogenous principles and varies in amount with the character of the food taken. The daily excretion is from 0.5 to 0.7 grammes when the diet is mainly vegetable, being increased to one or two grammes when upon an animal diet. Haig, who has given the subject of uric acid considerable study, makes the quantitative relation of urea and uric acid excreted of more importance than the absolute quantity of the latter, placing the proportion at about one part or less of uric acid to thirty-three parts of urea. Much of the daily quantity of uric acid is excreted as neutral urate of sodium and potassium. Uric acid itself is but slightly soluble in water, but is readily dissolved in alkaline fluids. This high degree of insolubility leads to the precipitation of all but the slightest trace (1–20,000).

In order to estimate the daily excretion add to a portion of the collection one-tenth of its bulk of hydrochloric or nitric acid, and allow the mixture to stand in a cool place for forty-eight hours, when the liquid may be poured off, the crystals washed with water, collected upon

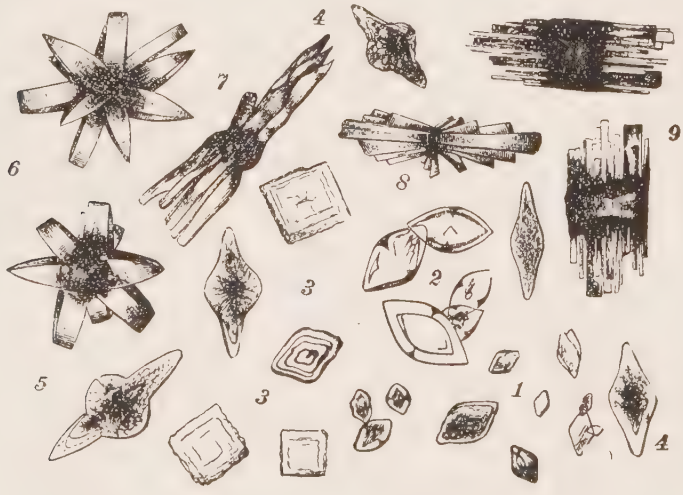


FIG. 26.—FORMS OF URIC ACID. (Landois and Stirling.)

(1) Rhombic Plates; (2) Whetstone Forms; (3) Quadrate Forms; (4), (5) Prolonged into Points; (6), (8) Rosettes; (7) Pointed Bundles; (9) Barrel forms precipitated by adding hydrochloric acid to the urine.

a weighed filter paper, which is to be again weighed after drying. For the detection of uric acid, either free or in combination, dissolve a little

of the suspected matter upon a watch glass with a drop or two of nitric acid, heat until dry, then add a portion of a drop of ammonia, which will give a crimson-purple or violet color (murexid test). If present in sufficient quantity to become visible to the unaided vision, uric acid resembles in appearance red pepper grains, if precipitated to the bottom of the graduate; or is of a slight yellowish tint if attached to its sides. This pale form is often overlooked. Chemically pure uric acid is colorless, the yellowish, reddish or brownish tints being derived from the coloring matter of the urine. Uric acid may be present in a neutral and even in an alkaline urine.

Under the microscope a great variety of crystals are observed, the basis of which is the rhomb. This is altered so as to develop the so-called "whetstone," or ovoid form. Resemblance to a spear, fan, a double comb, dumb-bells, a barrel, etc., have led to special names. The crystals may be single or aggregated into visible bodies forming rosettes, stars, etc.

Clinical Features. The relationship of uric acid to the gouty diathesis invests it with considerable diagnostic importance. Unless it has appeared after acid fermentation, which leads to its precipitation some hours after the passage of the urine, frequent tests must be made to determine its quantity and its relationship to general conditions. If detected immediately or soon after the urine is voided the danger of separation and aggregation of such crystals within the urinary tract should be considered.

Mixed Urates.—These appear as a reddish deposit (brick-dust or lateritious deposit), which disappears upon heating the urine, and is composed of the salts of uric acid, this substance combining with potassium, ammonium, sodium, calcium and magnesium. In health nearly all the uric acid is held in these combinations, which are very soluble at the body temperature, but are quickly precipitated in the form of amorphous granules when the temperature of the urine is reduced. Deposits of mixed urates may occur thus, although present in the urine in normal proportion, and also when the urine is of unusual acidity or highly concentrated. This precipitate is readily redissolved by potassium hydrate, which reagent leaves amorphous phosphates unaffected. Their appearance under the microscope is that of amorphous granules of a slightly pinkish color tending to aggregate into mats of irregular shape.

A deposit of urates may take place after excessive eating (particularly of meats) and drinking, or as a consequence of fever; the urine is usually highly acid and concentrated under these circumstances. A deposit of urates due to cold is usually without special clinical significance. Occurring under other circumstances it may be one of the expressions of a gouty constitution. Urates may attach themselves to some substance as a nucleus, and thus form a urinary calculus. The fact that mixed urates are dissolved by alkaline substances has been turned to account

in the treatment of this form of concretion, alkaline waters being employed as a drink for lengthened periods of time. But results from this method of treating renal calculi have never been very satisfactory.

Ammonium Urate. The ammonium, like the sodium, salt is crystalline and readily recognized under the microscope. It is difficult or impossible to distinguish between these crystals, some observers considering them identical. They take the form of brownish spherules, which may have spicular projections ("hedge-hog" or chestnut-burr" crystals). Ammonium urate forms in putrescent urine, and is then associated with crystals of triple-phosphate. It is sometimes seen in the scanty urine associated with febrile attacks in children, which, if frequently repeated, may lead to the formation of urinary concretions.

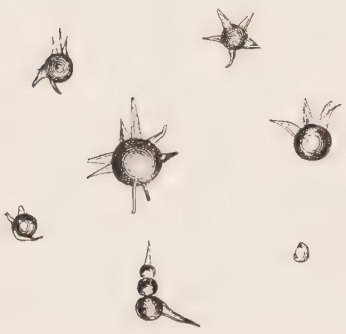


Fig. 27.—Urate of Sodium.

The Chlorides.—Next to urea the chlorides constitute, so far as quantity is concerned, the most important solid constituent of the urine, amounting in the course of the twenty-four hours to from ten to sixteen grammes. The chloride of sodium is the most important; it is accompanied by small quantities of the chlorides of potassium, ammonium and magnesium. In health their quantity is increased by indulgence in a diet rich in common salt and by exercise, while they are diminished by physical inactivity.

The simplest test for their detection is conducted by adding a few drops of nitric acid to the urine to prevent precipitation of phosphates, followed by the gradual introduction (drop by drop) of a strong solution of nitrate of silver (1 part to 8 of distilled water), stopping only when the white precipitate of chloride of silver ceases to form.

This precipitate is soluble in ammonia. If the chlorides are present in normal amount the precipitate will be flaky and settle to the bottom of the glass. If diminished, a milkiness only will be manifested. Various degrees of density of the flakes, or of milkiness of the urine, will suggest the amount of reduction of the chlorides. The absence of a precipitate shows that these salts are entirely absent. This test, while not scientifically accurate, is sufficiently so for ordinary clinical work.

For quantitative analysis we have Mohr's nitrate of silver method and the use of the centrifuge as suggested by Purdy.

Mohr's Nitrate of Silver Method for the Detection of Chlorides. For this test there are required a saturated solution of neutral chromate of potassium, and a solution of nitrate of silver prepared by dissolving 29.075 grammes of the pure fused salt in distilled water and diluting to one litre. Ten cubic centimetres of urine are

poured into a platinum crucible, and in it are dissolved one to two grammes of nitrate of potassium. The mixture is next evaporated slowly to dryness. The heat is then continued, but with increasing intensity, until the carbon in the residue is completely oxidized. A white molten saline mass remains, which is dissolved in a little water and placed in a beaker glass. The solution is next acidulated faintly with nitric acid, and a sufficient quantity of calcium carbonate added to make it neutral. The excess of lime is then filtered off. Now add two or three drops of the potassium chromate solution to the mixture and then permit the standard nitrate of silver solution to flow in from a burette, drop by drop, stirring the mixture throughout the process, stopping as soon as a distinct red color remains. To estimate the amount of chlorides multiply the number of cubic centimetres of silver solution consumed by .010 gramme, which will give the amount of chlorides in ten centimetres of urine. This method is not accurate when the urine is albuminous or putrid. When the urine is high colored, it is necessary to dilute it to a normal color.

Purdy's Centrifugal Method. The Purdy percentage tube is filled with urine to the ten centimetre mark. Nitric acid is added to prevent precipitation of phosphates; then the tube is filled to the fifteen centimetre mark with silver nitrate solution (1 part to 8 of distilled water). The solutions are then thoroughly mixed and placed in the centrifuge, which is operated at a speed of about 1,000 revolutions per minute for about three minutes. The amount of sediment is indicated upon the scale. Purdy places the normal bulk of chloride sediment at 16 to 18 per cent.

The chlorides are diminished in quite a variety of acute febrile diseases, especially those associated with serous exudation. Their diminution and even absence in pneumonia have attracted the most attention. They diminish rapidly with the increase of the disease, and increase with the advent of convalescence. Their entire disappearance during the course of pneumonia is regarded as of very unfavorable omen; their return, a favorable indication. They are also diminished in chronic indigestion and dropsical accumulations. They are increased in diabetes insipidus, and in dropsical cases in which free diuresis has been established.

Phosphates.—The phosphates of the urine may be divided into two groups, viz., the earthy phosphates, *i. e.*, the phosphates of calcium and magnesium, and the alkaline phosphates, *i. e.*, the phosphates of sodium and potassium. The earthy phosphates constitute from 2.25 to 3.50 grammes of the daily urinary secretion, the magnesium salt being in about double the quantity of the calcium salt. They are insoluble in water, freely soluble in acids, are precipitated by alkalies, and when in alkaline urine, by heat. Their precipitation from alkaline urine by heat

affords a frequent error in urinary examination, inasmuch as the cloud thus formed may be mistaken for albumin. Unlike the precipitate of albumin, however, it disappears promptly on the addition of an acid.

The alkaline phosphates are the acid phosphate of sodium and the phosphate of potassium, the former being present in much the larger quantity. Their total quantity in the twenty-four hours ranges from 2 to 4 grammes. They are soluble in water and alkaline solutions.

Ammonio-Magnesium Phosphate—the so-called triple phosphate—is formed by the action of ammonia on magnesium phosphate. When fermentation of the urine takes place, as in retention attending cystitis and spinal cord disorders, the ammonia set free reacts with the magnesium phosphate with the above-mentioned result. The same change takes place in decomposing stale urines. Ammonio-magnesium phosphate is recognized by the microscope as feathery or " coffin-lid " crystals.

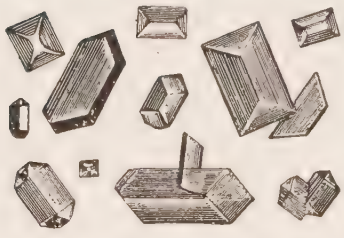


FIG. 28.—CRYSTALS OF TRIPLE PHOSPHATE.
(v. Jaksch.)



FIG. 29.—TRIPLE PHOSPHATES.

TEST FOR THE TOTAL PHOSPHORIC ACID ELIMINATION. This is best done approximately by Teissier's method. A glass cylinder graduated in cubic centimetres is required. In this are poured 50 centimetres of urine and 15 centimetres of magnesian fluid.* These fluids are well mixed and set aside for sedimentation for twenty-four hours. A dense white deposit of ammonio-magnesium phosphate is formed. The number of cubic centimetres this occupies is noted. For each cubic centimetre there are 0.30 grammes per litre, or 0.03 per cent. of phosphoric acid. To convert the result into grains per fluid ounce, multiply the result in grammes by 4.55.

This test may be utilized in connection with Purdy's centrifuge for more accurate volumetric analysis. The percentage tube is filled with urine to the 10 centimetre mark; magnesian fluid is added to 15 centimetres: the fluids thoroughly mixed and the tube placed in the centri-

* Magnesian fluid is composed of a mixture of: Magnesium sulphate, pure ammonium chloride, strong liquor ammonia, each 1 part; and distilled water, 3 parts.

fuge, which is revolved for three minutes at a speed of 1,000 revolutions per minute. The result is then read. According to Purdy, the normal standard by this test is from 8 to 12 per cent. by bulk.

Detection of the Earthy Phosphates. The urine is made strongly alkaline and heated. The earthy phosphates are precipitated as a whitish cloud, which is redissolved on the addition of an acid.

Detection of the Alkaline Phosphates. The earthy phosphates are precipitated as above and removed by filtration, then add the magnesian fluid in the proportion of one part to three of urine. This precipitates the alkaline phosphates as a white cloud, which amounts to a milky turbidity if they are normal in amount; a slight turbidity if diminished; and a dense precipitate if increased.

Significance of the Phosphates. In health the phosphoric acid elimination increases after the midday meal and reaches its maximum in the evening. In disease, it is diminished in gout and in organic renal affections. This latter fact is greatly ignored by clinicians, although Clifford Mitchell and Purdy have laid much stress upon it. The total phosphoric acid is increased in numerous diseases of the bones.

The alkaline phosphates are increased by an animal diet.

Sulphates.—The sulphates in the urine are those of sodium and potassium, the former being in much the larger quantity. Their total quantity in the twenty-four hours has been placed at from 1.5 to 3 grammes.

Their quantity is approximately estimated by adding to 10 centimetres of urine about one-third of its bulk of acidulated barium chloride solution.* If the sulphates are normal in quantity, a milky turbidity appears; if in excess, a more opaque and thicker turbidity; and if diminished, a mere opalescence.

The quantity may also be estimated by the centrifuge. Place 10 centimetres of urine and 5 centimetres of acidulated barium chloride solution in the percentage tube and revolve at the rate of 1,000 revolutions per minute for three minutes and note the depth of the resulting sediment. Normally, this should amount to 1 per cent.

In the present state of knowledge alterations in the quantity of sulphates are possessed of but little clinical significance. They are generally increased and diminished in the same proportions as urea. They are increased by a meat diet, by exercise, during the course of acute fevers, and especially during meningitis, rheumatism and encephalitis.

Carbonates.—Carbonates are found in very small quantities in urine of alkaline reaction. Their presence is manifested by the escape of gas on the addition of an acid. Urine containing carbonates in increased quantity is either turbid on passage or shortly becomes so.

* Consisting of barium chloride, 4 parts; hydrochloric acid, 1 part; and distilled water, 16 parts.

Alterations in the quantity of carbonates eliminated possess no pathological significance.

Oxalic Acid.—Oxalic acid exists in and is eliminated from the body, in its free state, in but minute quantity. Some observers believe that it is never thus present. As found in the urine it is combined with lime, forming the characteristic and interesting calcium oxalate crystals. These are observed in several forms, the most common being rectangular octahedra, which are remarkable for their regularity. Less frequently crystals of this substance possess a resemblance to an hour-glass, dumb-bells or square columns with pyramidal extremities. The less characteristic forms must be distinguished by their chemical reactions. The crystals are transparent, and are crossed at their centre by two diagonal lines, their appearance having been compared to that of an envelope. They are insoluble in water, soluble in the mineral acids and slightly so in urate and phosphate of sodium. Their color distinguishes them from uric acid crystals presenting similar forms.



FIG. 30. — OXALATE OF LIME CRYSTALS. (v. Jaksch.)

Oxalate of lime does not present a visible sediment, but is usually found in the cloud which floats near the bottom of the urine.

CLINICAL IMPORTANCE. Oxalate of lime may be present in the urine of healthy persons after the use of food containing oxalates, especially rhubarb, tomatoes, apples, pears, etc. Its presence alone is not, therefore, indicative of disease. It is sometimes associated with uric acid deposits, and may be incidental to gout. It is frequently associated with disordered nutrition, as observed in dyspeptics. If present in the urine of a person who is or has been suffering from nephritic colic, it is suggestive of the nature of the calculus. Vierordt emphasizes the fact that the simple presence of oxalate of lime crystals does not prove the existence of oxaluria.

Creatin and Creatinin are normal constituents of the urine. They permit of transformation one into the other. Creatinin may be detected by Weyl's test, which consists in adding to the urine a few drops of nitroprusside of sodium, and then a weak solution of caustic soda. The reaction gives a burgundy-red color which gradually changes to yellow, after standing, if creatinin is present.

Creatinin is diminished in most diseases characterized by wasting or anæmia, and is increased especially in the infectious disorders.

Hippuric Acid ($C_9\ H_9\ NO_3$) is found in the urine of persons who have taken benzoic acid or related chemical substances, although it may also be formed from the proteids. It is without color or odor. Its quantity increases if the diet is largely vegetable. It is recognized as fine

needles or four-sided prisms. The characteristic crystal is a vertical rhomboid prism.

Xanthin ($C_5 H_5 N_4 O_2$) exists in normal urine in minute quantity. It is a close relative of uric acid, which substance has one atom more of oxygen. It may deposit spontaneously, and then appears under the microscope as a yellowish-white scale. If united with nitric acid and evaporated, a yellow stain remains, which becomes yellowish-red upon the addition of potash, and of a violet or reddish-violet color upon heating.

This substance may enter into the formation of calculi which are of a characteristic deep yellow color and have a smooth surface.

Cystin ($C_3 H_6 NSO_2$) is one of the rare substances found in urinary sediments. Its origin is not understood. In very small quantities it cannot be considered as pathological. It contains a large percentage of sulphur, is soluble in ammonia, but recrystallizes upon evaporation. It is very slightly soluble in water. The crystals are six-sided prisms, varying greatly in size and possessing a pearly lustre. They are found particularly in light-colored acid or alkaline urine. If decomposed, the odor of hydrogen sulphide is developed, also that of ammonia. The sediment may or may not be associated with cystin calculi. It is light and appears much like amorphous urates, but is not dissolved by heat. Cystin is insoluble in solutions of carbonate of ammonia, and is often precipitated from an acid urine by alkaline fermentation. A tendency to cystin deposits appears to be hereditary, as certain families have a strong tendency to free precipitation of this substance in the urine. We know very little of the clinical significance of cystin beyond its clear relationship to diseases of the liver. It is thought to appear in greater frequency in ill-nourished children, anæmic women, and in certain diseases, especially in rheumatism.

Leucin and Tyrosin are usually found associated in the urine and are products of the same digestive disorders. They are crystalline in form, and associated with the presence of bile pigments in the urine, acute yellow atrophy of the liver, or poisoning with phosphorus. They also appear when suppuration is free. The crystals are readily developed by the evaporation of a little of the urine.

Leucin ($C_6 H_{13} NO_2$) spheres resemble oil-drops in being round, highly refractive and having a slight yellowish tint. Careful observation brings into view striæ, both radiating and circular. The spheres are disposed to aggregate and the dark borders are not as wide as those of fat-drops, which they resemble. Leucin crystals resemble those of sodium urate, but the latter may have spines and are

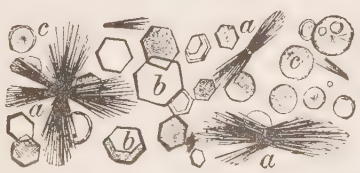


FIG. 31.—(v. Jaksch.)
(*a*) Tyrosin; (*b*) Cystin; (*c*) Leucin.

soluble by heat. From oil-drops they differ by their insolubility in ether.

Tyrosin.—This substance develops white sheaf-like crystals which tend to adhere to each other, especially at their constricted portions. If boiled with water, and a little mercuric nitrate added, a red color is imparted to the precipitate, while the overlying fluid becomes red or violet-red.

Leucin and tyrosin are usually associated. As these substances are the result of decomposition, they form in the normal organism in but small quantity, theoretically not at all; they are increased and appear in quantity when retrograde metamorphosis is progressing rapidly.

Proteids.—A number of proteids are found in the urine. Of these the most important are: (1) Serum albumin, which is the variety most frequently present and which is coagulable by heat and mineral acids. (2) Acid albumin (syntonin), which is formed by the action of a free acid upon serum albumin. (3) Alkali albumin, which is similarly developed by the action of a free alkali. (4) Serum globulin, which always accompanies serum albumin in albuminous urine, but in varying proportions. It coagulates at the same temperature as does serum albumin. (5) Peptone, which is a product of albuminous food acted upon by the gastric or pancreatic juice. It is not infrequently associated with serum-albumin. The peptone of the urine is not always food-peptone, but may be due to the conversion of albumin within the bladder by means of a ferment. Peptones are not coagulable by heat. (6) Propeptone (hemi-albumose) is a transitional stage of albumin before its change into peptone. It is not coagulated by boiling, but is precipitated by a solution of chloride of sodium or acetic acid, the fluid being cleared by heat and again precipitated by cold. If a drop of acid nitrate of mercury is added and heat applied, a dense red color appears, providing chloride of sodium is not present.

Albumin.—Serum-albumin, with its modifications, and serum-globulin (paraglobulin) are the clinically important forms of albumin observed in the urine. It is rarely necessary in practice to distinguish between them. As to whether serum-albumin is a normal constituent of the urine, as advocated by Posner, there is a want of agreement. The great importance of appreciable quantities of albumin in the urine has led to an exaggeration of the serious significance of minute traces. The fact that albumin is sometimes present in the urine for years, its presence being intermittent or constant, without any of the evidences of a kidney lesion being associated, and that in many of these cases the albumin ultimately disappears, indicates that an albuminuria which is independent of recognizable disease of the kidneys may exist. Even should disease of the kidneys ultimately supervene, it may be but a late manifestation in a long series of changes, and

does not certainly indicate the dependence of the early albuminuria upon renal disease.

While in the majority of cases in which albumin appears in the urine renal disease is present, the presence of this abnormal constituent must not be regarded as necessary to a diagnosis of Bright's diseases, for some cases of these affections run their entire course without manifesting albuminuria. Except when the quantity of albumin is large, its amount cannot be regarded as having any prognostic importance. Mere traces of albumin are often found in the most serious cases.

Albuminuria sometimes appears by reason of certain blood changes which render the albumin of that fluid more easily diffusible, hence permitting it to escape by the kidneys. We have illustrations of this in the albuminuria of anæmia, scorbutus, infectious diseases and certain poisons.

Albuminuria may also attend diseases of the circulatory apparatus, of the liver, certain forms of dyspepsia, serious inflammatory affections, malignant disease, purpura, scorbutus, gout and various affections of the central nervous system. It is often present in the urine of young ill-nourished individuals, and even later in life without other evidence of disease of the kidneys.

The important pathological factors in albuminuria may be indicated as follows: (1) inflammatory changes in the epithelium of the kidney; (2) alterations in the vascular apparatus, which becomes abnormally permeable as the result of inflammatory change or the influence of poison, or from vaso-motor paresis; (3) changes in the blood leading to more ready diffusibility of its albuminoid constituents.

The Test by Means of Heat remains the most satisfactory one for the general practitioner. The urine to be tested should be fresh, and unless quite clear, it should be filtered. In cool weather it is best to first warm the fluid, in order to remove any opacity due to amorphous urates. The test-tube employed should be perfectly clean and bright. If, upon boiling, a cloudiness appears which is not removed by a few drops of nitric or acetic acid, it is due to albumin. If dispelled, the opacity was due to earthy phosphates. It is advised to add the acid after boiling, for fear of the production of acid albumin, which may fail to be precipitated by heat, also for the further reason that the addition of the acid to cold urine may precipitate mucin. In respect to the use of acid, in tests by heat, it is important to remember that after the coagulation of the albumin by heat a few drops of nitric acid may cause its disappearance in some degree, but that it is restored if a larger amount is added. In noting the presence of albumin the test-tube should be held before a black background.

An admirable modification of this test is accomplished by filling the test-tube with urine, adding a few drops of acetic acid and boiling

only the upper half of the column, when, if albumin is present, even in very minute quantity, a slight opacity will be readily detected by comparison with the lower portion. This test is exceedingly delicate, easy of performance and highly satisfactory for ordinary use.

Purdy has devised a modification of the heat and nitric acid test, for which he claims great delicacy and accuracy, inasmuch as it obviates any danger of confusing mucin with albumin. The specific gravity of the urine is raised about ten or fifteen degrees by the addition of a perfectly clear saturated solution of common salt. A test-tube is then filled about two-thirds with the mixture, one or two drops of acetic acid added and the upper inch or so of the specimen boiled. If albumin is present the fluid will become cloudy.

Heller's Test. Place a quantity of clear nitric acid in a test-tube, and with a pipette float a layer of the suspected urine upon its surface, which is readily accomplished on account of the higher specific gravity of the acid. The test-tube should be held in an inclined position and the urine dropped slowly upon its lower side. If albumin is present, a white ring will form in the urine just above the acid. The brownish stratum, which is also developed in a variable degree, is the result of the action of the acid upon the coloring matters of the urine. When these substances are present in large amount, as in fever, the band is broad, of a deeper brown, and the albumin ring may be tinted with the same. Rings of a brownish-red result from blood-coloring matter, while a green tint indicates bile, and a rose or violet, indican. A white ring, simulating that due to albumin, is due to acid urates and is dispelled by heat, which must be cautiously applied to prevent ebullition and a dispersion of the albumin.

Aside from the well-known heat and nitric acid tests for albumin, a large number of new tests have been introduced of late, one of the most important of these being the *test by picric acid*, which has been strongly advocated by so able an observer as Dr. George Johnson, who considers that albumin is the only substance in normal or abnormal urine precipitated by picric acid, which cannot be dissolved by the employment of heat. Many authorities regard this test as not altogether reliable. Johnson advises the floating of a saturated solution of picric acid upon the surface of the urine in a test-tube. The contact layers must actually mix in order to obtain a good result, which is accomplished by most cautious agitation. If the urine is highly alkaline and ammoniacal, it is advisable to first add acetic or nitric acid, filter and employ picric acid as before. The light specific gravity of the picric acid solution permits it to be floated upon urine of ordinary specific gravity, but if the urine is very light they will mix at once. The writer employs the following plan: Mix in equal quantities saturated solutions of common salt and picric acid at ordinary room temperature, and employ this compound to underlie the urine, as in the Heller test.

Tanret's Test. This test is in general use because of its supposed delicacy. It does undoubtedly detect very minute quantities of albumin, but it is open to the objection of precipitating also all the modifications of albumin, peptone, proteoses and the vegetable alkaloids. The test-fluid is prepared as follows: Potassium iodide, 3.32 grammes; bichloride of mercury, 1.35 grammes; acetic acid, 20 cubic centimetres; distilled water, to 100 cubic centimetres. The test-fluid is used by the contact method; its specific gravity being high the urine is made to overlie it.

Test-papers for the detection of albumin in urine have been prepared and advocated by Dr. Oliver. Most of the reagents in use for urine testing were originally prepared in this manner, but all but the mercuric and ferrocyanic papers have been discarded, even by Oliver himself. The special value of this method is their ready employment at the bedside. They are prepared by taking chemically inert filter paper, cutting it into slips of proper size and soaking them in the test-fluid. After drying they are ready for use. The method of employment is as follows: Drop into a test-tube a test-paper and one of citric acid, and add about a drachm of water, agitate for about half a minute and remove the test-paper. Into this fluid the urine to be tested is allowed to fall, drop by drop. If, with the mercuric solution, four drops, and with the ferrocyanic, six drops, do not give rise to slight opacity, albumin, if present, is in such small quantities that the Heller test, after one minute of exposure, would not reveal it.

If there is no degree of opacity resulting from the addition of these amounts, the addition of urine should be continued, and if ten drops for the mercuric and fifteen for the ferrocyanic are required for the production of opacity, the amount of albumin present could be readily detected by boiling and acid. If twenty drops for the mercuric and thirty for the ferrocyanic are required to develop a trace of albumin, it indicates an amount of this substance which could be demonstrated only by delicate use of the acidulation and heat test.

Estimations of the Quantity of Albumin in the Urine are of value for comparative purposes. The most accurate method is by boiling the urine with acetic acid, filtering and weighing the albumin after it becomes dry, and deducting the weight of the filter-paper. For easy estimation it is common to filter the urine for the removal of urates and other substances which might add to the bulk of the precipitated albumin, boil, add a few drops of nitric acid and allow the albumin to settle in a graduated test-tube for from twelve to twenty-four hours. The result is indicated by the relationship of the bulk of the albumin to the amount of urine; *e. g.*, it represents one-tenth, one-fifth, or a larger percentage of the urine. Esbach has devised an albuminometer which permits of a more accurate carrying out of this method. It consists of a graduated tube, which is sufficiently explained by the accompanying

cut, when it is known that each line indicates one gramme of albumin to the litre of urine. The test solution employed consists of 10 grammes of picric acid, 20 grammes of citric acid and water to one litre. Fill the tube to U with urine, then to R with the test-fluid. After closing the tube with a rubber stopper the contents are to be gently mixed and left for twenty-four hours undisturbed. This method possesses the disadvantage of precipitating all the proteids of the urine—mucin, peptone, etc.—but notwithstanding this it is a convenient and fairly satisfactory method. The centrifuge may be employed for the precipitation of coagulated albumin and gives a rapid and satisfactory result. If the urine contains much albumin it should be diluted with one or two parts of



FIG. 32.—PURDY'S PERCENTAGE TUBE.



FIG. 33.—ESBACH'S ALBUMINOMETER.

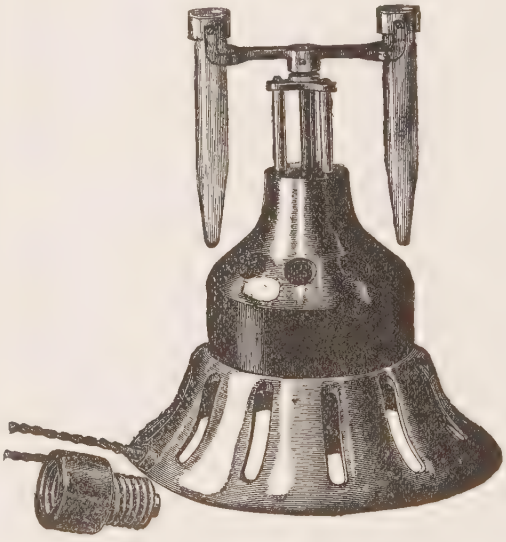


FIG. 34.—PURDY'S ELECTRIC CENTRIFUGE.

water and the result multiplied accordingly. The percentage-tube is filled to the ten centimetre mark with urine. To this are added $3\frac{1}{2}$ cubic centimetres of a 10 per cent. solution of potassium ferrocyanide, and $1\frac{1}{2}$ cubic centimetres of acetic acid. The fluids are thoroughly mixed, the tubes placed in the centrifuge and revolved at the rate of 1000 revolutions per minute for three minutes. Each cubic centimetre of deposit represents 1 per cent. bulk measure of albumin.

Peptones and Hemi-albumose.—To test for peptone, acidulate the urine slightly with acetic acid, saturate it with ammonium sulphate and filter. The addition of potassio-mercuric iodide (Tanret's test-fluid) or picric acid solution will cause a white precipitate, if peptone be present.

Another test consists in removing the albumin, if present, by heat, nitric acid and filtration. Then cover a small quantity of Fehling's solution in a test-tube with an equal quantity of the filtered specimen. At the line of contact of the two fluids there will appear a zone of phosphates (which will occur with any urine), and above this a rose-pink halo, if peptone or hemi-albumose be present.

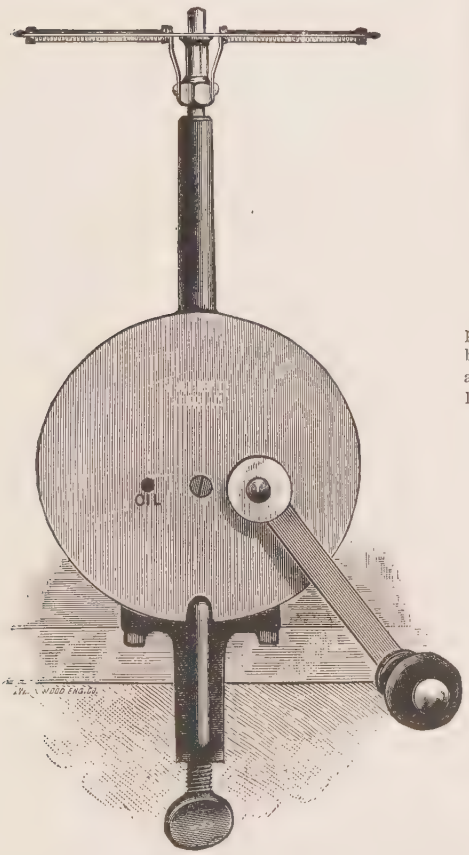


FIG. 35.—THE METZGER HAND CENTRIFUGE, WITH DALAND'S ATTACHMENT FOR BLOOD EXAMINATIONS IN POSITION.

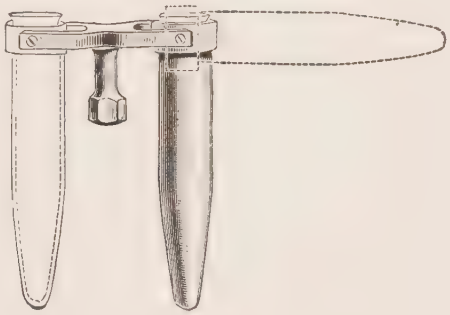


FIG. 36.—CENTRIFUGE ATTACHMENT FOR SEDIMENTATION OF URINE.

The horizontal dotted lines on the right show the position assumed by the tubes while in motion. Each branch of the attachment supports two tubes, an outer and an inner; the former being made of aluminium, the latter of glass.

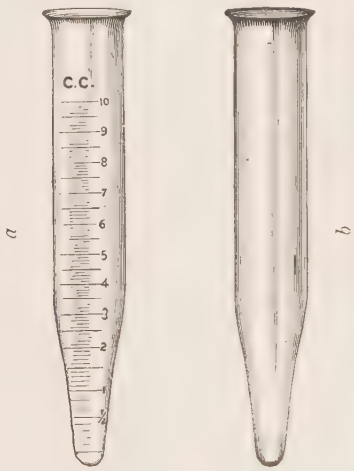


FIG. 37.

(*a*) Graduated tube for quantitative analysis with Metzger's Centrifuge. (*b*) Plain tube for sedimentation of urine for microscopic examinations.

Sugar.—The question as to whether normal urine contains sugar has excited considerable investigation, with the result of opposing statements; Bence Jones and Brücke asserting its presence, while Seegen, Pavy, George Johnson and others deny it. While a trace of sugar may be sometimes present in a specimen of urine in other respects normal,

there appears to be insufficient evidence that it is an ingredient of the healthy fluid.

Tests for glucose are based upon the power of this substance to reduce metallic salts to a lower state of oxidation or to the metallic state. Of the various tests Trommer's has heretofore proven most satisfactory to the author. Fehling's test, formerly much used, is now largely superseded by Haines's; it is used in the same manner as Fehling's, is even more susceptible, and presents the vast advantage of not spoiling on being kept. As one should be familiar with different tests, several will be described.

Trommer's Test. (1) Pour into a broad test-tube a few drachms of the urine to be tested, which must be free from albumin, this being readily accomplished by boiling and filtering; (2) add about one-third or one-fourth its bulk of liquor potassæ; (3) filter, removing earthy phosphates; (4) to the mixture add, drop by drop, a solution of cupric sulphate of a strength of about twenty grains to one ounce of water, and carefully note the result. After one or more drops have been added a dense blue precipitate of hydrated cupric protoxide takes place, which, if sugar is present, is redissolved as it gradually mixes with the fluid. In order to secure more positive evidence the copper solution should be added until slightly in excess, *i. e.*, until the precipitate is no longer dissolved, when the mixture should be kept at the boiling point for a few seconds (not more than half a minute). If sugar is present, a free precipitate of cuprous hydroxide takes place. This substance is of a bright yellow color, but becomes red with longer boiling, losing its water and being transformed into the red cuprous oxide, which falls and attaches itself to the sides and bottom of the tube. The yellow color first appears in the upper stratum. If time is not important the test-tube may be set aside before boiling and left for twelve or twenty-four hours, when, if, sugar exists, the precipitate will have formed. The latter method is more accurate, as it eliminates errors growing out of the presence of substances in the urine which reduce the copper salts when at a boiling temperature. The greenish deposit of the earthy phosphates has been eliminated, or it might confuse. Uric acid may be a source of error, its presence being suspected if the urine is scanty and high-colored.

Fehling's Test. The solution for this test is prepared by (1) dissolving 34.652 grammes of chemically pure crystallized sulphate of copper in 200 grammes of distilled water. (2) To 480 grammes of a solution of caustic soda (specific gravity, 1.14) add 173 grammes crystallized neutral sodic tartrate. (3) Slowly unite these solutions and dilute to one litre. This mixture possesses the disadvantage of deterioration from age. To avoid this the sulphate of copper may be dissolved in 500 centimetres of distilled water, increasing the tartrate salt and soda solution to the same amount, when the two can be mixed in equal quantities

at the time of using. The bottles may be labelled "Fehling, No. 1," and "Fehling, No. 2." All reagents used should be chemically pure.

Method of Use. (1) Place in a test-tube a quantity of the test-fluid and dilute with about four times its bulk of water. (2) Boil for ten seconds, and if the fluid remains clear (if the solution does not remain clear a fresh one should be prepared), (3) add the urine in drops, when, if sugar is present, a yellowish precipitate is formed. (4) If the yellow reaction does not promptly appear, the addition of more urine, with occasional reapplication of heat, may be continued until the amount of urine added equals the quantity of the test-fluid.

An estimation of the amount of sugar present in a given specimen of urine may be made with Fehling's fluid by determining the smallest quantity of urine sufficient to decolorize a given quantity of the test solution. Careful experiments indicate that 0.05 grammes of glucose will decolorize 10 centimetres of Fehling's fluid. The volumetric process, as advised by Tyson, is as follows: (1) Heat 1 centimetre of Fehling's solution in a large test-tube with 4 centimetres of distilled water. (2) Boil. (3) If the fluid remains clear, proving its good quality, add one-tenth centimetre of the suspected urine from a graduated pipette. (4) Heat again and add another one-tenth centimetre. This is continued until the blue color is entirely removed from the test solution. If, on accomplishing this, 1 centimetre of urine has been added, it will indicate one-half of 1 per cent. If more than 1 centimetre, the sugar will be less than one-half per cent., but more than one-fourth per cent. If 2 centimetres are employed it will indicate precisely one-fourth per cent. If only one-half centimetre is used it indicates 1 per cent., while one-fourth centimetre equals 2 per cent. If the amount of sugar is large the urine should be diluted with nine parts of water and the result multiplied by 10.

Haines's Test. This test was devised by Prof. W. S. Haines, of Chicago. The directions for preparing the test-fluid are as follows: Dissolve 30 grains of pure sulphate of copper in one-half ounce of distilled water; add one-half ounce of pure glycerin, and, after thorough mixing, 5 fluid ounces of liquor potassæ.

Of this fluid about one drachm should be boiled in a test-tube. Add slowly six to eight drops only of the suspected urine, followed by a second gentle boiling. The presence of sugar is indicated by the appearance of a copious yellowish-red or yellow precipitate.

Bismuth Test. The bismuth test of Böttger, which is based upon the power of sugar to reduce bismuth salts, is as follows: Place a few drachms each of the urine to be tested and liquor potassæ in a test-tube, and add about two or three grains (a pinch) of bismuth subnitrate. Boil for a number of minutes, when the liquid will turn brown and the metallic bismuth will be deposited as a black powder upon the sides of

the test-tube. It is best to add very little bismuth at first, as the amount of sugar may be only sufficient to give to the bismuth a grayish color.

Before applying this test it is necessary to be sure that albumin if present is removed, as the sulphur which it contains interferes with the test. It should be removed by filtration after acidulating with acetic acid and boiling.

Fermentation Test. This test is based upon the development of alcoholic fermentation by the addition of brewers' or compressed yeast, glucose being the only substance known to exist in urine which will undergo such fermentation. The simple plan of conducting this test which was advised by Roberts has been much employed. The steps are as follows: Pour about four ounces of the urine to be tested into a six-ounce bottle, cork loosely and preserve at an ordinary room temperature for twenty-four hours. During this time the bottle must be protected from draughts of cold air and in a quite warm and even temperature. If sugar is present carbonic acid gas is liberated and escapes with the result of lowering the specific gravity in proportion to the amount of sugar present. Less than 0.5 per cent. is not detected by this test, as the water will absorb all the carbon dioxide given off by this amount of sugar (Roberts). The specific gravity must be taken after the completion of the test and compared with that previously recorded. Each degree lost corresponds to one grain of sugar for each fluid ounce of the urine. The percentage of sugar present may be arrived at, approximately, by multiplying the number of degrees lost by .23.

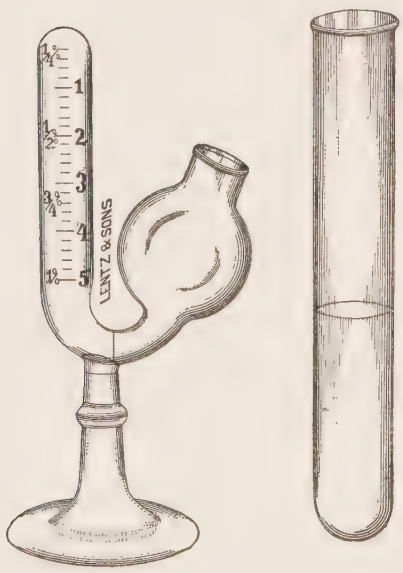


Fig. 38.—Einhorn's Saccharimeter.

The saccharimeter of Einhorn is a convenient instrument for quantitative analysis. To 10 centimetres of suspected urine add 1 gramme of compressed yeast and mix thoroughly. Fill the bulb of the saccharimeter with this mixture and gradually incline the instrument until the fluid has completely filled the graduated tube, forcing out the atmospheric air. Set aside for twenty-four hours in an even temperature, with freedom from draughts of air, when, if sugar is present, the graduated tube will be in some degree filled with carbonic acid gas. The graduation indicates the percentage of sugar in 10 centimetres of the urine employed.

Picric Acid and Potash Test. This test has been popularized by

Dr. George Johnson, and is performed by adding to a quantity of urine in a test-tube one-half the amount of a saturated solution of picric acid and the same of liquor potassæ. If sugar is present the fluid assumes a dark red color upon boiling, the depth of color depending upon the amount of sugar. Both uric acid and kreatinin add somewhat to the color of the urine when boiled with these test-fluids, but never the mahogany red displayed by sugar.

Sugar in the urine is in the great majority of cases indicative of diabetes mellitus. The amount varies from a trace to 30 to 50 grains to the ounce. It may be continuously present for years, or intermittent, the latter being often the result of treatment. The urine is usually increased in quantity, the patient often passing one or two gallons during the twenty-four hours and occasionally very much larger quantities are observed. The specific gravity is raised in proportion to the amount of sugar.

A transient appearance of sugar in the urine (glycosuria) may result from excessive indulgence in sugar and starch, or in association with various diseases of the nervous system, injuries of peripheral nerves, lung affections, cirrhosis of the liver, malaria, etc.

Bile.—The appearance of bile in the urine is manifested by reactions developed with the bile pigments and biliary acids.

Oliver's Test for the Biliary Acids. This test is claimed to be very delicate, as it will detect one part of bile salts in 18,000 parts of salt solution. A standard peptone solution* is the test-fluid. The urine must be thoroughly clear and made acid in reaction. If of a specific gravity above 1008, it must be reduced by dilution to that point. To 60 minims of urine add 20 minims of test-fluid. If the bile acids are normal in quantity, there will appear in a few minutes a slight milkiness. If they are in excess, the opacity will appear at once and be the deeper according to the quantity present.

Gmelin's Test for Bile Pigment. A few drops of urine are placed on a porcelain plate. Nearby are dropped a few drops of fuming nitric acid. The two fluids are then caused to flow together. At the point of union, if bile pigments be present, there will appear a play of color—green, blue, violet, red and yellow.

Marechalt's Test. Upon a small quantity of urine in a test-tube let fall a few drops of tincture of iodine. At the point of junction between the two liquids will appear a green band.

The bile acids accumulate in excess in the blood in quite a variety of forms of deficient liver action, with the result of producing toxic symptoms, these symptoms disappearing in a measure on the elimina-

* Pulverized peptone (Savory & Moore's), ʒss; salicylic acid, 4 gr.; acetic acid, ʒss; distilled water, to 8 oz. This must be filtered repeatedly until perfectly clear.

tion of the salts by the urine. Oliver and Purdy take the view that many of the symptoms attributed by Haig to uric-acidæmia are really cases of this character. Increased biliary salts in the urine are found in high fevers, hepatic congestion, cirrhosis of the liver, malarial fevers and numerous organic hepatic diseases.

The biliary pigments are always found in the urine in cases attended by jaundice, especially if caused by obstruction of the bile ducts. Very often the bile pigments may be discovered in the urine several days before a jaundiced hue is visible.

Indican.—*Heller's Test.* To 1 drachm of pure hydrochloric acid in a small beaker add 10 to 20 drops of urine, the mixture being stirred during the process. If indican is present in normal amount, the mixture appears of a pale yellowish-red, but if in excess, there appears a violet or blue color. This latter change does not take place immediately if the excess is slight, but may be delayed fifteen minutes.

The most important matter of clinical interest connected with an excess of indican in the urine relates to its occurrence in association with intestinal putrefaction. Neftel regarded it as pathognomic of cancer of the liver.

Examination of the Urine for Casts.—The examination of the urine for casts and other minute objects is a matter of great importance, and is accomplished as follows: The specimen of urine should be placed in a conical glass carefully covered and placed aside in a cool place to settle for twenty-four hours. With a pipette a portion of the lowermost sediment is withdrawn, placed on a microscope slide and covered with a thin cover glass. It is now ready for examination with the microscope. A one-fifth or one-sixth objective will suffice.

It is, however, better by far to secure sedimentation of the urine by centrifugal force, using either Purdy's electric centrifuge, or Daland's adaptation of the von Hedin hæmatocrit. With revolutions of from 1000 to 1500 per minute it is possible to get a good sediment for microscopic inspection in a minute or two. This sediment is, moreover, so closely packed in the bottom of the tube that the supernatant urine can be poured off, leaving the sediment and one or two drops of urine behind. These may be shaken up, poured on a slide and covered with a cover glass. This procedure has numerous advantages. It permits an examination of the urine before decomposition changes have taken place; the anatomical elements of the urine are more closely packed, hence more of them are conveyed to the slide; and the examination can be made without the usual delay of twenty-four hours.

Various theories accounting for the formation of casts have been promulgated. The one most generally accepted holds that they are formed by the escape of the coagulable elements of the blood into the renal tubules. If any detached or altered anatomical elements happen to be

present or the epithelial lining of the tubes is loosely attached, these structures become entangled in the basement substance of the cast, giving to it its distinctive characteristics. Other theories attribute casts to a secretion of the morbidly irritated renal epithelium, and to packing into moulds of disintegrated epithelium of the renal tubules.

The best classification of the different varieties of casts is that adopted by von Jaksch. He first recognizes two chief classes: The unorganized and the organized. The former are composed of crystals mainly of urates and hæmatoidin, and are of little pathological significance. The organized casts consist of cellular elements or their disintegrated products, and include the following subdivisions: (1) Those consisting of cells, including blood casts, pus casts, epithelial casts and bacterial casts. (2) Those which consist of the products of cellular change, and include the granular, waxy and fatty casts. (3) Hyaline casts.



Fig. 39.—Cast of Urates.

It is not uncommon to designate hyaline casts to which blood cells, epithelium, etc., are attached as blood casts, epithelial casts, etc.

The cellular casts of all varieties possess the greatest clinical significance, inasmuch as they furnish indubitable evidence of some affection of the kidneys.



Fig. 40.—Blood Cast.

Blood Casts. Blood casts are observed in the urine under circumstances giving rise to renal hæmorrhage, although but rarely observed under the microscope because of their obscuration by the large sediment of blood usually present in these cases. They attend acute nephritis, acute congestion of the kidneys and hæmorrhagic infarction of the kidneys.

Epithelial Casts. These consist of epithelial cells from the tubules of the kidneys imbedded in the basement substance of the cast. In some cases but two or three scales are observed; while in others the epithelial exfoliation is so extensive as to constitute an epithelial cylinder. They are usually found in acute nephritis, but may attend any form of renal inflammation.



Fig. 41.—Epithelial Cast.



Fig. 42.—Epithelial Casts, not Rich in Epithelial Cells.



FIG. 43.—PUS CAST.

PUS CASTS. These are usually associated with epithelial exfoliations, and are indicative of suppurative renal disease.

GRANULAR CASTS. The granular matter imbedded in the hyaline substance of the cast gives this variety its name, and is the result of retrograde changes in blood cells or tubular epithelium. According to the size and abundance of the granules they are referred to as finely or coarsely granular; highly, moderately, light or dark granular. They are significant of chronic or degenerative disease of the kidneys.



FIG. 44.—FINE GRANULAR CASTS.

FATTY CASTS. These are characterized by the presence of minute oil globules in the basement substance of the cast. They are regarded as an unfavorable symptom, being present when the kidneys are undergoing fatty degeneration.



FIG. 45.—COARSE GRANULAR CAST.

HYALINE CASTS. These consist of casts which are perfectly transparent, the nature of which has not yet been positively determined. According to von Jaksch and others, they are sometimes found with normal conditions. Some claim, however, that they are never present excepting where albuminuria exists or has existed. To make their discovery certain they should be stained by some coloring substance, a dilute solution of iodine in iodide of potassium or methylene-blue having been recommended for this purpose. In the the hands of skilful microscopists hyaline casts may be discovered without staining processes, especially by shifting the position of the microscope mirror and so altering the direction of the illuminating rays (oblique illumination). When stains are employed care should be taken not to use too much.



FIG. 46.—NARROW HYALINE CASTS.



FIG. 47.—BROAD HYALINE CAST, CONTAINING A FEW DROPS OF OIL.

WAXY CASTS. These are observed as homogeneous refractive cylinders. They are longer than other varieties of casts, and



FIG. 48.—WAXY CASTS.

are not infrequently segmented. They are found in acute and chronic nephritis, interstitial nephritis and amyloid degeneration of the kidney.

Epithelium. Epithelial deposits from different sources are very frequently found in urinary sediments. It is only when they become excessive that they can be regarded as of pathological import. Very often in normal urine there is a faint cloud formed on standing, which contains the epithelium. The association of an epithelial deposit with the presence of pus cells or other abnormal structures, shows that the former is the result of disease.

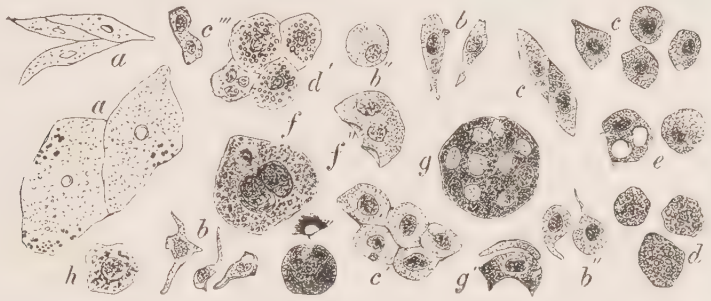


Fig. 49.—Urinary Epithelium. (v. Jaksch.)

a, *a'*, Squamous epithelium from the urinary sediment. *b*, *b'*, *b''*, Epithelium from the bladder. *c*, *c'*, *c''*, *c'''*, Epithelium from the kidneys. *d*, *d'*, Fatty epithelium from the kidneys. *e–h*, Epithelium from the bladder.

Epithelium from each portion of the urinary tract has been assigned special characteristics by which their origin can be recognized under the microscope. The trend of authority, however, is to the view that it is utterly impossible to make such differentiation by these means. Bladder epithelium is in general large and flat. Vaginal epithelium, so frequently found in the urine of women, is remarkable for the large size of its scales. Epithelium from the tubes is apt to be small, spherical and nucleated and with an indistinct cell wall. It is wise not to depend too much upon these characteristics, however, and study the associated phenomena in order to reach a correct conclusion.

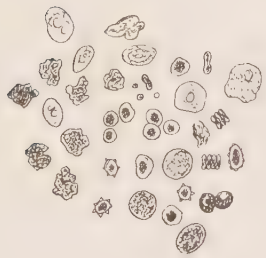


Fig. 50.—Blood and Pus Cells.

Micro-organisms.—The abundant organisms and spores in the atmosphere and upon the vessels used for collecting and preserving urine, find in this solution of organic matter a fluid favorable to their colonization. The most important fungi are those which excite alkaline fermentation, with the development of carbonate of ammonia from the urea. Such fermentation may also take place in the bladder and result from the introduction of the organisms upon unclean instruments, or their entrance from the urethra, which is favored by paralysis of the bladder. The inevitable result is catarrhal inflammation. Most import-

ant of these organisms are the micrococcus ureæ and the bacillus ureæ. The former, which is a chain coccus; and the latter, which is thicker and shorter than the bacillus of tubercle, are actively mobile. The moulds, especially penicillium, appear upon urine preserved for a few days. The saccharomyces cerevisiæ (yeast fungus) grows actively in saccharine urine, and is a test for sugar. It appears as oval cells which are granular and which multiply in the main by budding. Gonococci, which have the form of diplococci, are present in the urine of persons suffering from gonorrhœa. These organisms are found within epithelial cells and pus corpuscles as well as free, their presence in the pus corpuscles being considered the characteristic feature. Recent observations have demonstrated the existence of a diplococcus in the urethra of healthy individuals which closely resembles the gonococcus, but which does not penetrate pus cells. Streptococci and bacilli, which are morphologically and in point of staining like the bacilli of tubercle, are also inhabitants of the urethra.



Fig. 51.—Bacillus Tuberculosis. (v. Jaksch.)



Fig. 52.—Yeast Fungus. (v. Jaksch.)

The presence of tubercle bacilli in the urine is evidence of tubercular disease of some portion of the genito-urinary system. They are often found in large numbers. The method for their detection is the same as applied to sputum. The centrifuge is very valuable for this purpose. Purulent urinary sediments, the origin of which is not clear, should always be examined for this bacillus. Pathogenic organisms related to various general diseases may find their way into the urine accidentally, *e.g.*, the bacillus of tubercle, pus micrococci, pyæmia, etc., or those of erysipelas. Nephritis has in some cases been attributed to the action of bacteria found in the kidneys and urine. In rare instances the hooklets of echinococcus are found in the urine and indicate hydatid disease in some portion of the urinary tract. Still less frequently the distoma hæmatobium, the filaria sanguinis, the strongylus gigas, and other parasites are met.

PYURIA.

Pus in the urine may occur as a temporary phenomenon, the result of irritation of any portion of the urinary tract, such as may be excited by dietetic errors, exposure to cold or the passage of irritating urine containing much urates, phosphates, or oxalates, especially in ill-nourished, elderly and gouty persons. Aside from these transient causes, pus may be due to inflammation of any portion of the urinary mucous membrane, to abscess of the kidneys or of tissues external to the urinary apparatus and discharging into it.

Localization of the Lesion in Pyuria. The determination of the seat of the lesion causing pyuria has important bearings on questions relating to prognosis and treatment, and is fortunately a problem of comparatively easy solution in the majority of cases. In a general way it may be stated that a purulent acid urine suggests kidney disease; a purulent alkaline urine, vesical trouble. A renal origin is suggested also in those cases in which the discharge of pus is intermittent. The explanation of this phenomenon is found in obstruction of a ureter by a plug of muco-pus, a calculus, or by a twist. The obstruction being partially removed at times, a discharge of pus takes place.

The "three-glass test" gives valuable information not obtained in any other way. The anterior urethra is to be first washed by a boracic acid solution and the washings preserved for examination. The patient is next directed to urinate one or two ounces in a glass, and, finally, one or two more ounces in another glass. If the second contains pus and the third does not, then the conclusion that the pus comes from the deep urethra is justified. If both the second and third glasses contain pus in the same proportions it must come from either the bladder or kidneys. If the third specimen is clear, showing that the bladder and kidneys are free, still another experiment may be made to determine whether or not the pus in the second glass originated in the prostate or seminal vesicles. After passing urine into the two glasses, as above directed, the well-oiled finger should be introduced into the rectum and firm massage of the prostate performed. This will cause the evacuation of pus into the deep urethra, from which position it may be washed by another urination into a fourth glass.

To determine whether the pus comes from the kidneys or bladder resort may be had to the cystoscope, which will discover the escape of cloudy urine from the ureters. But this method is too highly technical for the use of the general practitioner. That proposed by Sir Henry Thompson is available to all, and is carried out thus: The bladder is emptied with the patient standing. It is next thoroughly washed with a boracic acid solution. The catheter is permitted to remain *in situ*. The bladder is collapsed around the instrument, so that the urine escapes quite directly from the ureters into the catheter, and is thence carried into the receiving vessel, drop by drop.

Purulent urine is always more or less albuminous, because pus is an albuminous fluid. It is always important to know whether or not albuminuria exists independently of the pyuria, for if the two are coexistent, kidney disease is in all probability present. This point is to be decided by a comparison of the quantity of albumin with the amount of pus corpuscles in the specimen.

Pyuria, as already stated, sometimes results from the opening of an abscess into the urinary passages. Such cases are characterized by the

sudden onset of the purulent flow, the relief occasioned by the discharge and the presence of physical signs pointing to a localized inflammation.

It is very exceptional indeed that pyuria exists without symptoms pointing indisputably to some definite locality as the seat of the trouble. In all cases, especially those originating outside of the urinary tract, it is of the highest importance to obtain a complete clinical history, especially as to the mode of onset.

HÆMATURIA.

Hæmaturia is a symptom of a variety of affections involving the system at large or the urinary organs primarily. The blood may enter the urine from any portion of the urinary tract, viz., the kidneys, ureters, bladder, prostate or urethra. The diagnosis of hæmaturia consists, first, in the recognition of the hæmorrhage; secondly, its source; and thirdly, the nature of the pathological lesion. The presence of blood corpuscles in the urinary sediment is readily recognized by the microscope. If any further test is required, blood may be demonstrated by means of a mixture of guaiacum and turpentine, which, if well shaken and the urine slowly added, will develop a rich blue color. Spectrum analysis is capable of detecting minute quantities of the coloring matter of the blood, absorption lines appearing between D and E in the yellow and green. Heller's test for the detection of hæmoglobin is readily performed as follows: Add to the urine an equal portion of liquor potassæ and boil until the flocculi of phosphates appear, which, upon settling, will present a reddish-brown or reddish-yellow color.

Etiology.—Hæmaturia occurs as the result of traumatism and as a symptom of renal hyperæmia, both active and passive; also in all forms of Bright's disease, but especially in acute nephritis and the later stages of interstitial nephritis. It attends malignant disease of all portions of the urinary tract, purpura hæmorrhagica, scurvy, leucocythæmia, pernicious anæmia, various acute infectious diseases, especially yellow fever and smallpox. It may attend embolism, thrombosis or infarctions of the kidney, and is a frequent result of injury to the ureter during the passage of calculi. Certain drugs, especially cantharides, turpentine and chlorate of potash, have the power of exciting bloody urine. The frequency with which different causes produce hæmaturia is well illustrated by Fenwick's clinical observations, which, however, exclude traumatism, gonorrhœal prostatitis and ordinary nephritis. The following figures are based upon 100 cases in hospital practice:

Tumors of the bladder	31 cases.
Renal diseases, including carcinoma, tubercle, stone and syphilis	24 "
Tubercular and other forms of ulceration of the bladder	22 "
Hæmorrhagic cystitis	12 "
Encysted vesical stone	5 "
Prostatic hæmorrhage	4 "
Uncertain	2 "

In private practice his observations were as follows:

Vesical stone	10 cases.
Tumors of the bladder	24 "
Stone in the kidney	6 "
Tubercle of the bladder	3 "
Tubercle of the prostate	2 "
Renal carcinoma	2 "
Cystitis	2 "
Enlarged prostate	1 "

Diagnosis of the Seat of Hæmorrhage.—As guides to the seat of hæmorrhage we have the color of the urine, the shape of the clots, the time at which the blood appears in the urinary stream, the permanency with which the effused blood is held in suspension in the urine, microscopic examination, and physical examination of the urinary organs. With but few exceptions, it may be stated that the brighter the color of the blood, the nearer is its source to the urinary meatus. When, as the result of injury or malignant disease, the flow of blood is profuse, its quantity causes it to appear almost at once at the exit of the urinary tract; hence it has undergone few or no changes. When blood escapes, *e. g.*, drop by drop into the bladder, it becomes mixed with residual urine, and when mixed with this discharge it presents an appearance not unlike that in the case of renal hæmaturia.

In the case of hæmorrhage from the ureters, the blood is discharged in long "earthworm-like clots." This sign becomes doubly characteristic when partially discolored clots of this shape are passed and their discharge is followed by a renewal of the bleeding.

In the case of vesical hæmorrhage, the clots are large, irregularly shaped and are bright red.

In prostatic and vesical cases, the flow often takes place towards the close of the act of micturition.

When the blood escapes from the urethra independently of urination, it must have had its origin in the urethra.

When the effused blood is so intimately mixed with the urine that it does not subside readily on standing, the hæmorrhage is nearly always from the kidneys or ureters.

Microscopically, the discovery of blood or granular casts affords indisputable evidence of renal disease.

In the majority of cases, physical examination affords some sign pointing to a portion of the urinary tract as the seat of disease. In carrying out the necessary manipulations due care must always be observed lest harsh handling aggravate the trouble. It is especially important to avoid instrumentation, particularly in cases in which there are no associated symptoms to indicate any one portion of the urinary tract as the seat of the disease.

When slight traumatism produces hæmaturia there is very good reason for suspecting latent malignant disease.

Prognosis.—This will depend upon the cause of the symptom, as it is indeed rare that the quantity lost is sufficient to prove fatal.

Treatment.—Treatment will be governed almost entirely by the nature of the disease exciting the hæmorrhage. In free hæmorrhage it is necessary to place the patient at complete rest, and feed and care for in general as in the case of serious loss of blood from any cause. Ice-bags may be applied over the seat of hæmorrhage. By way of recapitulation of what has been more fully stated in other sections, it may be suggested that when the hæmorrhage depends upon decomposition of the blood, as in infectious disease, *crotalus*, *lachesis*, *kali chloricum* and *arsenicum* may be considered. When due to inflammatory conditions of the kidneys, *aconite*, *turpentine* and *cantharis* are pre-eminently important. The bleeding due to calculi ceases with the passage of the stone, and that incident to malignant disease is but little under the control of medicine. In extreme cases, *ergotine* administered hypodermatically is strongly recommended. *Hydrastinine hydrochlorate* in the first decimal dilution is much more efficient.

HÆMOGLOBINURIA.

In certain conditions of deterioration of the blood the coloring matter is liberated and freely eliminated in the urine. Blood corpuscles are absent, or present in but small numbers, and there is no relationship existing between their number and the amount of coloring matter. The rapid solution of blood corpuscles which takes place especially in alkaline urine, must be remembered, as their absence from a specimen does not prove that they may not have existed at an earlier date. The coloring matter is not always hæmoglobin, but quite as frequently methæmoglobin. The urine is dark brown or even blackish, and has been compared to porter. If the coloring matter is in small amount, the urine may have a smoky appearance. Albumin is present, but the coagulum is of a brownish hue. A dense brown sediment is common. The microscope reveals granular débris, pigment, stained urates and epithelium. Spectroscopic examination reveals the three absorption bands of methæmoglobin, the band found in the red near C being regarded as characteristic. Less frequently, the two absorption bands of oxyhæmoglobin are present.

Etiology.—Hæmoglobinuria is not related to any form of kidney disease, but to destructive influences acting upon the corpuscular elements of the blood. The paroxysmal form is often due to the exciting action of cold. The specific poisons of many of the acute infectious forms of disease have been known to excite it, especially those of malaria, yellow fever, scarlatina, typhoid fever, etc. Cohnheim found it to supervene upon severe burns which were not rapidly fatal. Certain drugs, especially chlorate of potassium, carbolic acid, arseniuretted hydrogen,

pyrogallic acid, carbon dioxide, and several less important substances, have in large doses been known to excite it. Epidemic influences appear to be influential, as illustrated by the remarkable series of cases observed in new-born children by Winckel, of Dresden, in 1879, twenty-three out of twenty-four proving fatal. Such a series of cases could hardly be attributed to other than infectious causes. It has attended interstitial nephritis as an early symptom.

Morbid Anatomy.—Hæmorrhages may take place from the mucous membranes, also into the tissues. The renal structure is deeply tinted by the pigment matter which fills the tubes, is granular, and appears to be discharged by the malpighian tufts. The color of the kidneys is a dark brownish or chocolate. Alterations have been found in the spleen and in the bones.

Symptoms.—Aside from the urinary condition described there are more or less gastric irritation, jaundice, lumbar pains, feebleness of heart, purpuric spots, enlarged spleen, hypostatic congestion of the lungs, loss of flesh, and general failure.

Two varieties are recognized, the toxic and paroxysmal forms; the former has been sufficiently noticed.

Paroxysmal Hæmoglobinuria has been observed much more frequently in men who have been subjected to exposure to cold and severe exertion. It has apparently followed upon slight chilling.

The relationship of this affection to Raynaud's disease has excited some discussion, some considering paroxysmal hæmoglobinuria as one form of this affection. The duration of the paroxysms is very variable. Several may occur in a single day, or an attack may continue seventy-two or more hours. Cases have been reported in which intercurrent paroxysms have appeared presenting the general symptoms but with globulin only in the urine; presumably the amount of coloring matter freed in these cases is not so great but that it is disposed of by other organs, the kidneys removing the globulin.

An interesting form of this affection attacks horses, especially animals that are warmly stabled and occasionally exposed to cold and forced to severe exertion. The attack is usually sudden in onset and associated with paresis of the rear extremities.

Diagnosis.—From hæmaturia hæmoglobinuria is distinguished by the absence or limited number of red blood corpuscles in the urine; by the characteristic spectrum bands, and by the test with the tincture of guaiacum and hydrogen peroxide mixed in equal quantities, which substance, overlaid with the urine, gives a blue color. From renal calculus it is distinguished by less pain, as well as by its location and character, and by the absence of calculous matter in the urine. The mild attacks without much pigment in the urine resemble acute nephritis, but are more sudden in onset, of shorter duration, often attended by jaundice, and there is an absence of œdema.

Prognosis.—Most observers regard this as generally unfavorable, although Fagge, to whom we owe much of our knowledge of this affection, states that the paroxysmal form has never been known to destroy life. It is more serious when complicating serious primary disease, and malarial cases met in the South often prove fatal within a day or two.

Treatment.—Little of value has been established. The patient should be kept at rest and warm during attacks. Between the paroxysms the general nutrition must be improved by all possible means, taking into consideration food, rest, change of climate, etc. Avoidance of exposure to cold, severe exertion, and all deteriorating influences is highly important. I have obtained positive results from *kali chloricum* in the third to the sixth decimal, also from *ferrum phosphoricum* third decimal. These medicines have been persistently given, but singly, during the intervals between the attacks. *Crotalus, lachesis, kali cyanidum* and *terebinthina* should prove valuable medicines, but experience with them is as yet limited. Dr. S. Jones suggests *picric acid. Iodide of potassium* is applicable to syphilitic cases.

Fagge asserts the value of quinine in full doses, stating that it sometimes proves perfectly successful in warding off attacks, the patient becoming able to live his usual life without fear of the disease. The several drugs mentioned as producing the disease should be studied as possible remedies.

CHYLURIA.

Synonym.—Galacturia.

Definition.—A disorder common to tropical regions, characterized by a milky appearance of the urine, which in a portion of the cases contains a substance having the appearance of blood. After standing, coagulation takes place, and with the microscope a nematoid entozoon—the *filaria sanguinis hominis nocturna*—is found in the blood as well as in the urine.

History.—While chyluria is a disease of the tropics, visitors to or residents of this region occasionally import the affection into the temperate zone. This is especially true of England, which is so closely associated with many tropical countries. Tropical regions are not, however, affected equally in all parts, which is probably due to peculiarities in the distribution of the entozoon. This parasite was discovered by Lewis in 1872.

Etiology.—The cause of chylous urine has not been demonstrated, although plausible theories have been advanced by Sir William Roberts, Bernard and Robin, and also by Van Dyke Carter. The first observer met a remarkable case in 1868, in which a vesicular eruption formed upon the abdomen, discharging a chylo-lymphous fluid and accompanied for two days with chylous urine. Although a post-mortem examination

did not reveal evidence of a cause for the presence of the chyle in the urine, Roberts believed it to be due to a condition of the urinary tract, probably the anterior wall of the bladder, similar to that found upon the surface of the abdomen, but which had disappeared before death. A microscopic study of the skin and subcutaneous cellular tissue resulted in finding these tissues traversed by enlarged lymphatic channels, varying in size from a thread to that of a crow's quill. The French authors quoted refer it to piarhæmia (fatty blood), and, therefore, a persistence of the condition of the blood which is normal for a short time after taking food, and due to digestive derangement involving the liver particularly, and possibly to the entozoon. Carter attributes chyluria to a varicose state of the lymphatic vessels in some portion of the urinary apparatus, which condition is not without analogy. Theories as to the production of this state refer it to stenosis of the lymphatic vessels with resulting rupture, and in some manner due to the parasite or its ova. Accumulating experience favors the view of Carter. Certain cases reported as not associated with the filaria may have been due to pressure of morbid growths or various changes in the walls of the lymph vessels affecting their lumen, for there seems to be no reason to doubt that obstruction from various causes might lead to varicosity of the lymph vessels and a resulting chyluria.

Morbid Anatomy.—A few carefully conducted autopsies have been put upon record, but all have failed to discover more than a dilated and thickened condition of the thoracic duct and varicosity of the lymphatics of the lower portion of the body.

Symptoms.—The symptom of first importance is the milky urine, which may be the only symptom present. The urine is not always milky, however, but may be quite clear or have the appearance of containing blood, which latter feature may lead to a diagnosis of hæmaturia if a sufficiently careful examination is not made. These variations are accounted for by the presumption that the fluid is poured into the urine in various stages of its development. It appears to be demonstrated that the contents of the thoracic duct and other lymph vessels may, if retarded, pass on to the development of red blood corpuscles.

The urine coagulates soon after its passage, forming a gelatinous clot which contracts within a few hours. Coagula may form in the bladder obstructing the urethra, or in the pelvis of the kidney exciting renal colic. The specific gravity is most variable even in the same individual. Heat and nitric acid precipitate a coagulum. If shaken with ether, the milky appearance disappears. Careful analyses by Bence Jones, Beale and others, show the existence of fat, albumin and fibrin, but in very variable proportions, even in the same individual at different times. Observations to ascertain which of the fluids of the body gives to the urine its morbid elements have not resulted very satisfactorily, as

the nutritive fluids are undergoing constant change in the course of the day, due largely to the character and amount of food consumed. There is a decided want of relationship between the amount of fat contained in the blood or the chyle, and that in the urine.

Premonitory symptoms are usually wanting. The urinary changes may appear with suddenness and the patient complain of uneasiness or slight pain in some or all portions of the urinary apparatus. With progress of the disease there is failure in strength and flesh and despondency. Chylous discharges have been observed from the surface of the abdomen, from the groin, scrotum and axilla; or the disease may be associated with elephantiasis.

Prognosis.—This is in some cases an exceedingly chronic affection, having been known to exist during a period of half a century. There are intervals of freedom, however, during which the patient may appear to be in good health. If free from vicissitudes or serious internal disease, and the patient has good habits, life may be greatly prolonged; but bad habits, exposure, unfavorable occupations and surroundings seriously impair the general condition and accelerate the disease. Death may occur from intercurrent disease, especially of the pulmonary organs. There has not been sufficient experience of a favorable character reported to permit of the extension of hope of recovery or indeed of improvement.

Treatment.—Old-school medicine admits the insufficiency of all treatment, and we can offer little but theoretical suggestions. The large doses of *iodide of potassium*, *gallic acid*, *benzoic acid*, *iron*, decoctions of the bark of *rhizophora racemosa*, or of *nigella sativa*, which have appeared to some observers to give good results, have entirely failed in other hands or even later in the same cases. *Phosphoric acid* was suggested by Chapman (*British Journal of Homœopathy*), and presents much pathogenic and some clinical claims to consideration. *Terebinthina* is suggested by Ralfe. *Uva ursi* has also been commended. Rest in recumbency with the pelvis elevated is advised, based upon the pathology. Protection from cold and severe exertion and a residence in a mild climate are advisable.

SOME GENERAL CONDITIONS DEPENDENT UPON DISEASES OF THE KIDNEYS.

RENAL DROPSY.

The prominence of dropsy as a symptom of disease of the kidneys, Frerichs finding it absent in only one in about seven cases of Bright's disease, demands for it especial consideration. In regard to its relative

frequency in the several forms of Bright's disease, it may be approximately stated that it is present in nearly all cases of acute diffuse nephritis, in nine-tenths of chronic diffuse nephritis, but in not more than one-tenth of the cases of chronic interstitial nephritis until the stage of break-down of the hypertrophied heart, when fully one-fourth become dropsical.

Dropsy is an abnormal accumulation of fluid in the lymph spaces of the body. Œdema signifies an infiltration of the tissues with fluid; dropsy, in a more restricted sense, is applied to an accumulation of fluid in the various cavities. A general involvement of the superficial structures of the body is called anasarca. General dropsy signifies a combination of anasarca and involvement of one or more serous cavities. In the several forms of nephritis the causes of dropsy are the same, with the exception of that appearing in the late stages of interstitial nephritis, when this symptom is the result of failure of the heart, and is associated with other symptoms of general failure. Its first appearance is in the lower extremities, and in other respects it corresponds to cardiac dropsy of ordinary type.

Etiology and Pathology.—Dropsy is essentially due to a disturbance of the proper balance existing between the transudation of liquid from the bloodvessels into the tissue spaces and its removal by the lymphatic and venous systems.

The dropsical fluid, which is allied to blood serum, is watery, without color or of a pale yellow tint, and generally clear. It may be tinted by bile or by the coloring matter of the blood. The reaction is alkaline, and rarely, faintly acid. The specific gravity varies from 1006 to 1012 or 1015. It is composed of water and variable proportions of albumin, alkaline and earthy salts, and extractive matters in solution. Urea, cholesterin, pigments, etc., are also sometimes present. The composition varies in different situations, that contained in the subcutaneous tissues having less of albumin and other solids than the contents of serous cavities.

Conditions which give rise to a disturbance of this nicely adjusted process and lead to dropsical accumulation are (1) increased exudation of fluid from the bloodvessels, (2) diminished absorption upon the part of the absorbent vessels, (3) a combination of both. Extensive research (largely experimental) into the pathology of dropsy indicates that it may be the result of (1) changes in the composition of the blood leading to (2) alteration in the structure of the vessel walls and possibly to (3) nervous influences. While these conditions are favorable to dropsical accumulation, there can be no doubt of the pre-eminent importance of obstruction to the removal of fluid, for, as long as there is no impairment in the ability of the absorbents, dropsy is an uncommon symptom. The forces acting upon the lymph circulation are the heart's pumping

power—*vis a tergo*—and the aspiration of the chest during respiration —*vis a fronte*—assisted by the action of the muscular system. Impairment of this circulatory mechanism may cause dropsy by loss in the pumping power, which leads to too low a pressure in the veins. The influence of impaired heart power may be further aided, at least locally, by section of vaso-motor nerves, which results in greater blood pressure in the part and consequent increased outflow of fluid. Such is the nature of dropsy as observed in association with heart feebleness, but a far more complex pathology awaits the student of renal dropsy, and it cannot be asserted that it is a subject which is yet clearly elaborated in all its particulars. The first contention has been that renal dropsy is due to hydræmia, and it has been sought to support this view by experiment, but experimenters do not altogether agree as to the results obtained, for, while Jaccoud, who is supported by many able authorities, states that the production of the hydræmic dyscrasia by the injection of water results regularly in the development of dropsy of a temporary character, others have made statements diametrically opposed, notably Cohnheim, who injected salt solution under low pressure into circumscribed vascular regions without resulting œdema. This observer also joined Lichtheim in extended experiments to determine this point, these observers claiming as their result, that œdema is not produced by an unaided hydræmia. The important features of their experiments were the injection of large amounts of 0.6 per cent. solutions of chloride of sodium into the blood-vessels of dogs and rabbits at a low and carefully sustained pressure. A large number of experiments failed in but a single instance to develop anasarca or subcutaneous œdema. Preliminary experiments to determine the quantity of fluid which might be employed without danger to life resulted in administering to dogs as high as 92 per cent. of their body weight before a fatal result. An interesting feature of these experiments was the attempt to determine the influence of hydræmic plethora upon the vascular tension, and upon the rapidity of the circulation, and it was found that pressure could not be increased above the normal elevation for any length of time. All of the glandular organs secreted water in large amounts.

A consideration of hydræmia in its relation to the blood serum only, throws no light upon the subject. Frerichs found the solids of the blood serum in three cases of developing nephritis to be 9.19 per cent., while they were reduced to 2 per cent. in an animal, by the injection of salt solution, without œdema supervening.

The dropsical symptoms which were developed were localized in a manner supposed to be characteristic of hydræmic plethora, *i.e.*, involving the peritoneal cavity, the mucous membrane of the gastro-intestinal tract, and in a marked degree all of the abdominal organs. The chest organs, and those of the central nervous system were not involved. In

order to avoid the possibility of the point of injection influencing the result they took pains to make use of the jugular vein, various arteries, and the femoral vein, without affecting the result.

While experimenting upon these animals it was observed that superficial parts, whether injured by pressure, application of irritants or the ligation of vessels, developed œdema if hydræmic plethora was produced, or if a slight œdema existed it was increased. Largely upon these observations has been built the theory that injury of the bloodvessels is necessary to the development of œdema in association with hydræmia. As changes in the superficial vessels have not been demonstrated in dropsy, just how the injury originates is not yet explained. In such an affection as scarlatina, in which the superficial structures and vessels undergo change, the cause is apparent, but it is not so clear in relation to some other forms. The most plausible theory is that the morbid condition of the blood which is associated with hydræmia causes impairment of nutrition of the vessel walls. This theory is supported by the absence of œdema in association with the acute nephritis dependent upon many of the infectious but non-eruptive specific diseases, such as pneumonia and diphtheria. In further support of these experimental conclusions are the instances of complete suppression of the urine from calculous obstruction, of oliguria of hysterical origin, and of starvation, with little or no œdema.

The condition of the vessel walls permitting the passage of fluid into the tissues has been called by Cohnheim an "inflammatory" change, as it so closely resembles what occurs in inflammation. Defective enervation of the vessels may be a factor, but an accumulation of acids or other morbid products in the blood, a diminished amount of oxygen or albumin, or the presence of hæmoglobin in solution, have all been suggested as possible causes of increased permeability of the vascular tissues.

Symptoms.—The external evidence of dropsy is the puffy doughy swelling of the superficial structures, which pit upon pressure. The skin becomes pale (anæmic) from interference with the circulation in the cutaneous bloodvessels. The point of first development is usually the loose connective tissue about the eyes. If the patient remains in bed it may be first observed in the most dependent portions of the body, *e.g.*, about the body and hips. It is not uncommon for the pressure of the stethescope to leave a pitted ring which first suggests the existence of œdema, or the hand which has been permitted to hang down or upon which the patient has been lying, or which has been "corded" by some means, is discovered to be œdematous. Later, swelling develops in the lower extremities and gradually ascends, involving the superficial tissues of the hips, abdomen, and finally, those of the chest. The scrotum, prepuce, and labia in females, may be greatly distended. At a

still later period, some one or more of the serous sacs may be discovered to contain fluid.

Œdema also involves internal organs, notably the lungs, the air vesicles and small bronchi filling gradually until the air is excluded. Lungs in this condition are abnormally heavy, feel semi-solid, and upon section, quantities of yellowish serum containing air bubbles exude. The larger bronchi contain frothy muco-serous fluid. While the œdema is generally distributed throughout both lungs, a portion only of one may be involved. The existence of pulmonary œdema is announced by difficulty in breathing. A fact much less generally understood is that œdema attacks the walls of the gastro-intestinal tract, the stomach, intestines, or both being involved at the same time, and may prove fatal through vomiting, diarrhœa and collapse. The mucous membrane is filled with a serous fluid which is also pressed out upon its surface. These symptoms are usually attributed to other causes.

The time of appearance of renal dropsy varies much. In the tubular forms of nephritis it is a comparatively early symptom. In the acute variety it may be the first symptom to attract attention, but not infrequently the disease may exist for weeks before its development, and occasionally a case may pass to a fatal issue without œdema. In the chronic tubular variety it is quite constant and early developed. In interstitial nephritis it is a late symptom and incident to cardiac failure.

URÆMIA.

Etiology and Pathology.—The literal meaning of "uræmia" is urea in the blood. This term was first applied by Piorry, when it was believed that the complex of symptoms designated uræmia was due to the presence of urea in the blood. In the vast majority of instances uræmia is developed in the course of Bright's disease of the kidneys, but it may result from any cause which seriously, and especially suddenly, impairs the eliminatory function of the kidneys, *e. g.*, obstruction of the ureters. The theory of its dependence upon the presence of urea in the blood is still entertained by many notwithstanding the amount of evidence which has accumulated in opposition to it. The amount of urea found in the blood of persons suffering from uræmia has not been in excess of one per cent., and in many instances it has been less than one-quarter of that amount, while numerous investigators have injected or fed to animals quantities enormously in excess of this before a fatal issue resulted. The experiments of Peabody demonstrated that while it required 1½ pounds of urea to prove fatal to a dog, the blood of a man who died of uræmia contained only .009 pound of urea. It has been further observed in many instances that the largest amounts of urea which are ever found in the blood may be present without the coexistence of uræmic symptoms.

Frerichs modified this theory, the most important feature of his doctrine being that the urea, which is, *per se*, not injurious, is converted into carbonate of ammonia through the agency of a peculiar organized ferment. He was led to this conclusion by the resemblance existing between the symptoms resulting from intravenous injections of carbonate of ammonia and uræmia; and further, by the presence of carbonate of ammonia in the blood of persons suffering from uræmia. Regarding the latter point it may be stated that subsequent experiments are not in accord. Rommelaire considers that the amount of ammonia contained in the blood is insufficient for the production of uræmia, but that this agent is found in large quantities soon after death.

Since inability to attribute uræmia to the presence of urea or of carbonate of ammonia in the blood it has been suggested that it might be due to earlier excretory products, viz., creatin, creatinin, leucin and tyrosin. This view has been no better supported by experiment, and Sutton states "it is almost impossible to conceive but that there must be much accumulation of such excretory products in the blood when the kidney is not performing its functions properly, but we cannot consider that such accumulation is the main cause of the symptoms of uræmia. I speak like this because we have had to practice according to these chemical views, and they have proved unserviceable."

In 1881, Feltz and Ritter instituted experiments with fresh urine, to determine whether it might not possess a toxic influence. It was injected into animals with the result of producing convulsions, coma and death. It was further satisfactorily determined that neither the organic constituents nor the increased intravascular tension incident to the injections were factors in the production of the symptoms, but that the same result followed upon injection of the inorganic constituents of the urine, and that of these substances the potassium salts manifested the greatest toxicity.

Traube, especially, attributed the nervous features of uræmia to œdema of the brain, in turn the result, mainly, of the hydræmic state of the blood, but, according to Bouchard, "in the large majority of cases followed up by autopsy, cerebral œdema, ventricular dropsy, and cerebral anæmia are wanting. And not only has evaporation not demonstrated the existence of a larger proportion of water in the tissues of the brain than normally, but in place of anæmia it is easy to establish congestion pushed to the point of extreme fulness of bloodvessels and to ecchymoses."

It has been demonstrated by Lepine that febrile urine is much more poisonous than non-febrile urine, and the night urine has been shown to be less poisonous than that of the day; also that excreted in certain diseases is especially poisonous.

It must be evident to one reviewing this subject that we are not yet

in a position to explain the pathology of uræmia. It seems certain, however, that a variety of clinical types are included under this head, and that the cause is not the same for all, that a single causative agent may by reason of varying dose or duration of action be represented by various clinical groups, and, further, that many poisonous substances may be represented in the production of a single group. To quote again from Bouchard (auto-intoxication in disease): "I regard uræmia, then, as a complex poison, to which, in unequal proportions, all the poisons introduced normally into the organism or found therein, physiologically contribute, when the quantity of poison formed or introduced in twenty-four hours can be no longer eliminated in the same time by the kidneys."

Symptoms.—The symptoms of uræmia may appear in an acute or chronic form, and are referable particularly to the cerebrum, the respiratory, or the gastro-intestinal organs. Such a distribution of the symptoms has led to a classification into (1) cerebral; (2) dyspnœic; and (3) gastro-intestinal; a favorite method with the French, who have studied this condition with commendable zeal.

In considering these several groups of symptoms it may be first stated of the cerebral group that it is divisible into cases presenting with especial prominence convulsions, coma, mania, or insanity as prominent features.

The *convulsions* are of epileptiform type, closely simulating epilepsy, which has led to errors in diagnosis. The Jacksonian form may appear in its typical development. The onset of convulsions is sudden, and the fits may follow each other at intervals varying from a few minutes to several hours. I have observed a single convulsion of this character in the course of a nephritis. Coma exists during the intervals between the convulsions, although consciousness may be restored in light cases. A single spasm may prove fatal, but more frequently this result takes place after frequent repetition. Death is more likely to occur during the coma. Following upon the convulsions there may be temporary blindness (uræmic amaurosis). I have observed this symptom for days before the appearance of convulsions. The ophthalmoscope reveals nothing. Deafness occurs less frequently.

Coma is not only associated with the convulsive feature, but appears as a primary symptom. Under such circumstances it may or may not be preceded by symptoms of cerebral irritation, such as headache, vertigo, mental excitement, disturbances of vision or hearing, vomiting, impaired movements, slowness of speech, etc. The appearance of the patient varies much, the face being pale or flushed, and the pupils unaltered, dilated or contracted. The breathing, according to Stewart, is not stertorous, as in cerebral hæmorrhage, but has more of a hissing sound, produced by the expired air impinging upon the hard palate or

teeth. The coma is of uncertain duration, as death may occur within a limited number of hours or after many days of unconsciousness. Consciousness may return and with it recovery. Developing in one who has not been known to be a subject of nephritis, an error in diagnosis may take place without a thorough examination. In the more chronic form drowsiness passes gradually into coma, the patient finally cannot be roused and death soon closes the scene. There may be twitchings of muscles, especially those of the face.

Insanity. Mental aberration, particularly of a delusional kind, is an occasional feature of uræmia. The cause of the insanity has been often overlooked, the nature of the case being mistaken until the patient may have been committed to an asylum. A noisy mania, with restlessness and poor sleep, has been frequently observed. The patient is talkative, reiterating statements, yelling, singing or declaiming.

Respiratory Developments. Disorders of respiration are occasional developments in uræmia, and may be present in a variety of forms. The difficulty in breathing may appear and disappear as in an ordinary asthma (renal asthma), or it may be continuous, or present the peculiarities of the Cheyne-Stokes respiration. I have observed this renal dyspnœa in persons who had not been suspected to be suffering from Bright's disease.

As in the case of the several groups of symptoms already considered, those related to the gastro-intestinal tract may appear in such a manner as to be misleading without the aid of careful urinary analyses. Vomiting is the most prominent of these symptoms. It may appear as a morning vomiting or after food, but in some instances it becomes frequent, rapidly prostrating the patient and terminating fatally, as in the case of a lady seen with the late Dr. C. F. Goodno. In another case, which also terminated fatally, the vomiting had been considered as of hysterical origin. Diarrhœa may be associated with the gastric symptoms or may rarely appear alone. Both catarrhal and diphtheritic types of inflammation may be associated with this symptom.

Of other symptoms of uræmia headache, pruritus, localized paralysis, muscular cramps and twitchings, morbid sensations, such as formication, numbness, especially in the hands, a urinous odor of the breath, and profuse sweats with an accumulation of scales of urea upon the skin may be mentioned.

Jaccoud described an "articular uræmia" which possesses symptoms resembling articular rheumatism.

Diagnosis.—Acute uræmia is in most instances preceded by symptoms which suggest its nature, especially œdema about the eyes, ankles, or in some portion of the body; headache, delirium, defective vision, soporousness, restlessness, gastro-intestinal symptoms, etc. If with such symptoms the urine is albuminous and presents casts and other evidences of nephritis, the nature of the condition present is clear.

To distinguish between uræmia and other affections attended by convulsions and coma is sometimes difficult, particularly as some of these latter affections may be attended by albuminuria. A little time and several complete examinations of the urine are sufficient, however.

Epilepsy sometimes resembles uræmia. In an ill-nourished girl of fourteen years of age recently seen after her first epileptic convulsion, there was a history of not being well for some days, no one heard the early cry or noted a blanching of the face. The urine contained one-half of one per cent. of albumin, and there was a slight puffy appearance about the eyes, but it was not until several analyses of the urine had been made that it was determined that a nephritis did not exist. Subsequent observations have shown that albuminuria follows each attack, lasting sometimes for many days.

A variety of intra-cranial lesions presents close resemblances to uræamia. This is notably true of cerebral hæmorrhage, tumor and meningitis.

Cerebral hæmorrhage is usually distinguished by the attending paralysis, although hemiplegia as well as involvement of groups of muscles may be a feature of uræmia, and that, too, without the slightest appearance of a lesion at the autopsy. Under such circumstances a diagnosis may be impossible. Attention to the history of the case, the character of onset and an examination of the urine, are most important. If hemiplegia is complete and the eyes deviate in the same direction it is indicative of apoplexy. Meningitis with a slight degree of fever and other evidences of constitutional disturbance simulate uræmia, if associated with a marked degree of coma.

Narcotic poisoning, particularly with opium, simulates uræmic coma. Attention has been called to the pupillary changes, but they are too uncertain in uræmia to act as a guide. The ophthalmoscope may reveal retinal changes in association with uræmia, the urine is usually scanty and presents the evidences of a nephritis, the breath may be urinous, the temperature elevated, the pulse tension high, and the left ventricle hypertrophied. In opium poisoning the respirations are slow and stertorous. In alcoholic cases the coma is not so profound nor is the delirium of the same character as in uræmia. Suspicious cases of the above character are frequently brought into hospitals, and it is best to catheterize the patient at once and examine the urine. A persistent form of uræmia is not infrequently met in connection with some of the acute infectious diseases. The patient is heavy, delirious, sweats a good deal, the tongue is dry and coated, there are muscular twitchings and irritable stomach, and the urine is scanty and albuminous and contains granular casts. This condition is not unusual as a feature of typhoid fever and other protracted infectious diseases. Perfect recovery indicates the non-existence of renal disease prior to the occurrence of the fever. Such a slow uræmia may also occur and simulate infectious fevers.

In all cases of doubt it is to be remembered that complete and repeated examinations of the urine, including that by the microscope, are frequently essential to a correct diagnosis.

Prognosis.—The prognosis of uræmia depends largely upon the nature of the cause. It is under all circumstances a grave condition, but when associated with acute diffuse inflammation of the kidneys the majority recover if properly treated. In chronic diffuse nephritis the prognosis is less favorable, and when it is associated with chronic interstitial nephritis, it is usually the beginning of the end, although relief may sometimes be secured for a time. When excited by other causes than nephritis, the result depends upon the removability of the cause. In any form the intensity of the attack may destroy the patient within a limited number of hours, or even in a single convulsion. Persistence of uræmic symptoms after treatment has been instituted, such, for instance, as headache, morning vomiting and muscular twitchings, is less favorable than an acute attack of uræmic convulsions or coma, the latter being often precipitated by some unfavorable influence such as excitement or injudicious eating and, therefore, more readily relieved.

OCULAR CHANGES OCCURRING IN THE COURSE OF BRIGHT'S DISEASE.

The retinal changes which occur in the course of Bright's disease (*retinitis albuminurica*) have since their first description by Heymann, of Dresden, in 1856, become a most important factor, both in diagnosis and prognosis.

Of patients affected by renal disease, probably 25 per cent. will at some period of the trouble show a greater or less impairment in vision, due to degenerative alteration in the structure of the retina and optic nerve. The poor sight is usually bilateral, and is often the first symptom which leads through an ophthalmoscopic examination to the detection of the renal affection, though probably in but few cases is the visual disturbance at all an early manifestation of the kidney disease. The extent of the visual disorder varies greatly according to the location of the retinal destruction, and seems to bear no relationship to the extent of pathological changes in the kidney, and very rarely goes on to complete blindness. The color and light sense and the general outline of the visual field remain unaltered.

The so-called retinitis albuminurica is found associated with all forms of nephritis, but occurs by far the most frequently with the "granular" or "contracting kidney," and most rarely in the acute and waxy forms of the disease.

In the chronic variety a fatal termination may be looked for within two years after the detection of the retinitis.

When the retinitis is found associated with the acute nephritis of scarlatina and of pregnancy, the prognosis is naturally less grave as to life, and greatly deteriorated vision may be wholly restored upon the subsidence of the nephritis.

The ophthalmoscopic appearance of retinitis Brightii has very rarely been noted in the earliest stages, although it is probably that of a beginning general retinitis.

Later, there is present, as in retinitis from other causes, a haziness of the retina and optic disk (œdema), together with numerous scarlet blotches, usually striated or flame-shaped, indicating blood extravasations, but more particularly, as characteristic of the nephritic retinitis, there will be seen scattered over the central portion of the fundus numerous whitish spots or blotches of glistening white, varying from the size of a pin's head to more than the diameter of the optic disk. These retinal changes are peculiar in confining themselves almost entirely to the region about the optic nerve head and macula lutea. In the earlier stages the extravasations and white spots apparently involve mainly the nerve-fibre layers and appear linear and radiating, while later they show irregular blotches arranged about the papilla and macula, but without invading the immediate site of the macula itself. Most typically, though not always confined to the albuminuric form, the white dots and striæ will be arranged in a stellate figure, with the dark red macula as a centre.

These white patches have been found to be either foci of fatty degeneration or accumulation of granulo-fatty cells resulting from the absorption of hæmorrhagic extravasations. Very occasionally white opaque streaks are seen along the line of the retinal vessels (sclerosis), sometimes before the appearance of the typical picture of nephritic retinitis, and while not positive evidence of renal disease, furnish sufficient ground for careful investigation of the renal function, as should also a simply blurred or swollen optic disk without other sign of retinal disease. On the other hand, it must be borne in mind that ophthalmoscopic appearance very similar to the albuminuric is found, not only in diabetes and leukæmia, but occasionally when no distinct general disease can be discovered.

The precise connection between the renal and retinal disease has not yet been satisfactorily determined, as to whether the retinitis is caused directly by the nephritis, or, as is suggested by Michel, that both diseases may be dependent upon a common vascular degeneration affecting both renal and intra-ocular vessels.

During the course of a Bright's disease, more particularly that of a scarlatina or pregnancy, there occurs, infrequently, a sudden complete blindness of both eyes—*uræmic amaurosis*—followed, when the life of the patient is not lost, by restoration of the vision after a few hours or a day or two. The ophthalmoscopic appearances in these cases are entirely

negative, and the iris is usually active. The condition is commonly attended by other symptoms of uræmic poisoning, such as headache, sensory confusion, nausea, vomiting, convulsions and coma. Since it was first described but little has been added to our knowledge of uræmic amaurosis; the exact nature of the process producing the blindness being as yet unknown. The absence, however, of all ophthalmoscopic changes would indicate a poisonous action at the cerebral centres.

Of the rarer ocular manifestations of albuminuria may be mentioned cataract, iritis and paralysis of the ocular muscles; the presence of either one of which, without other manifest cause, should lead to a careful and repeated search for albumin. The few cases of muscular paralysis which have been reported, the most notable of which are those of Finlayson and Knies, have been associated with the later stages of nephritis, and are evidently due to hæmorrhages in the neighborhood of the nerve roots or nuclei.

CARDIO-VASCULAR CHANGES.

For a consideration of alterations in the heart and bloodvessels, see page 148.

DISEASES OF THE KIDNEYS.

HYPERÆMIA OF THE KIDNEYS.

ACUTE HYPERÆMIA.

Acute hyperæmia may result from cold, the action of the poisons and certain well-known substances used as medicine, particularly cantharides, turpentine, cubebs and copaiba. It constitutes the first stage of nephritis, may follow upon injuries, surgical operations, especially upon the urethra or bladder, the removal of one of the kidneys, or be caused by excessive exertion under unfavorable circumstances. It is a feature of most of the specific infectious diseases. Acute congestion may also result from influences causing vaso-motor paresis of the small arteries (exophthalmic goitre).

Morbid Anatomy.—The kidneys are swollen, softened, heightened in color and, upon section, blood flows freely. The capsule is not adherent. Careful inspection reveals an overdistended condition of the bloodvessels, the malpighian bodies being prominent, and if the pressure has been sufficiently great, the epithelium of the tubules may be flattened. Extravasations of blood may take place into the urinary tubules or the mucous membrane of the pelvis and ureter. The increased blood

pressure in the kidney is attended by leakage of serum and sometimes by the loss of blood corpuscles. Congestion may occur in normal organs or in those affected by some form of chronic disease.

Symptoms.—These are usually confined to changes in the urinary secretion which contains some blood, albumin and tube casts of a hyaline or epithelial character. The specific gravity is normal and the quantity often lessened. There may be some gastric irritation and aching in the region of the kidneys. Unless supervening upon some chronic affection the symptoms soon subside.

Diagnosis.—The history of a possible cause with the existence of the urinary conditions described, and particularly their rapid disappearance, are the distinguishing features of acute congestion.

Treatment.—This will depend considerably upon the nature of the cause. In all cases the patient should be put at rest, given a liquid diet and plenty of pure water to drink. Hot foot-baths and general baths at a temperature of about 100° F. are of decided assistance, increasing the activity of the skin and equalizing the circulation. If poisons have been taken the essential treatment is that best suited to the removal of as much of the poison as may remain in the stomach, and the antidoting of that which has entered the blood. The form which follows operations and proves so rapidly fatal has been uncontrolled by treatment. The medicines from which a selection may be made are those recommended for acute diffuse nephritis.

CHRONIC HYPERÆMIA.

A chronic stasis of blood in the kidneys is due to a variety of causes; in fact, any condition which impedes the systemic circulation, leading to increased blood pressure in the venous system, may be a cause of renal hyperæmia. The most prominent of these is chronic valvular disease of the heart, especially affections of the aortic and mitral valves, with the resulting dilatation. It may be caused also by obstruction of the circulation within the chest, such, for instance, as may result from emphysema or compression of the lungs by pleural effusion. In these various affections the obstruction acts first upon the right heart and in turn upon the venous system. In rare cases it may be due to obstruction in some portion of the inferior vena cava or in the renal veins, such obstruction being due to morbid growths, aneurism, etc.

Morbid Anatomy.—The kidneys are generally enlarged. In the form dependent upon heart disease, and commonly called cyanotic induration, the organ is not only enlarged, but the surface smooth, abnormally firm and the capsule not adherent. Section reveals an increase of color in the kidney, the pyramids having a purplish tint. The epithelium of the cortex is swollen and outlined with abnormal distinctness. It may be flattened. The vessels of the glomeruli are dis-

tended and their walls thickened. It is not uncommon for some degree of nephritis to exist or for an acute nephritis to supervene. Should the latter occur, albumin, tube casts and possibly blood will appear in the urine.

Symptoms.—As in the acute form, the condition of the urine is the most important feature. The secretion is usually diminished in quantity, albuminous, acid, deposits urates and often uric acid. There are a few tube casts in most cases which are of a hyaline variety. The urea is usually normal. The general symptoms are so intimately associated with those of the primary affection that it is difficult to determine what symptoms belong to the kidney lesion, and in what degree those caused by the primary disease are aggravated by the condition of the renal organs. Most cases present dyspeptic symptoms, dyspnœa, general failure in strength and flesh, some degree of dropsy, and finally, the symptoms of uræmia, viz., convulsions, coma or delirium.

Diagnosis.—The diagnosis depends upon the urinary state described, in association with the presence of a condition which may act as a cause of renal hyperæmia, especially disease of heart or lungs. It is often difficult to determine whether the condition is one of simple hyperæmia or of nephritis; but in the former casts are few, the amount of albumin is not large, and there is less disturbance of the general composition of the urine.

Treatment.—This must depend almost entirely upon the primary disease, and it is only necessary to refer to what has been said upon the subjects of chronic valvular disease of the heart and obstructive disease of the lungs. The general care of the patient involves rest, carefully regulated diet (the food containing little starch and sugar), and suitable attention to the skin. The conditions which call for active treatment are the feeble, irregular heart, dropsy, anæmia and gastro-enteric conditions.

BRIGHT'S DISEASES.

Prior to Bright's time it had been noticed that the urine of dropsical persons often coagulated upon boiling, and further, that dropsy was, in many instances, related to the kidneys; but it remained for the above-mentioned observer to demonstrate the dependence of these conditions upon lesions of the kidneys, which in their gross character, as we know them to-day, he clearly pictured in 1827. Since that time the relationship of albuminuria to disease of the kidneys has been fully recognized, persons so affected being considered as subjects of renal degeneration. Recent observations have extended the significance of this symptom. It is but justice to this truly great clinician to note that while his conception of the pathology of disease of the kidneys was not in advance of his time, he learned that in many cases albumin was present in but scanty

amounts, and that dropsy might be absent. He also detected the associated cardiac hypertrophy, his explanation of its origin being still held. Nor did the nervous symptoms, hæmorrhages and inflammations of serous tissues, which are dependent upon Bright's disease, escape his observation. The doctrine of Bright, which was in accord with contemporary pathological teaching, that the lesion of the kidneys in Bright's disease was in the nature of a deposit, was held until Rayer (1839) advocated its inflammatory nature. The first step in the differentiation of the several forms was made in 1852 by Johnson, who described the contracted red kidney. The same observer, and Rokitansky, in Germany, also independently recognized the amyloid variety. These observations were followed in 1858 by Virchow's classification of the disease into three varieties, based upon the tissue primarily involved in the inflammatory process, viz., (1) Parenchymatous nephritis, in which the lesion attacks the epithelium of the tubuli uriniferi. (2) Interstitial nephritis, the changes involving primarily the connective tissue. (3) Amyloid degeneration, the bloodvessels being first attacked. This classification has been in high favor even until the present day, but has proven too inflexible for many pathologists, who have proposed numerous modifications.

Accessory pathological conditions now received more attention, the most remarkable observations being those of Gull and Sutton, who in 1872 made known the existence, and frequent association with the contracting kidney, of a thickening of the minute arteries and capillaries, the term arterio-capillary fibrosis being applied. This condition they considered as intimately related to the pathogenesis of the contracted kidney.

The observation of intermediate varieties has shaped modern thought upon this subject, which is opposed to the idea of a nephritis which is strictly parenchymatous or strictly interstitial, but is in the direction of the recognition of a diffuse nephritis, the anatomical features of which depend upon the activity of the process, consequently upon the rapidity of progress of the inflammatory lesion. If this is of slight intensity and greatly prolonged, the small roughened kidney results, the large white organ being the product of intense action, which may be protracted or repeated.

ACUTE BRIGHT'S DISEASE.

The term acute Bright's disease embraces several varieties of acute inflammation of the kidneys. The least developed form, due to the action of irritants, which may be inorganic or associated with infectious disease, is considered by some pathologists as an imperfectly developed inflammatory process and classed as an acute degeneration. I can see no reason, however, for separating its description from that of acute

diffuse nephritis, as it is due to the same causes, and pathologically is the same in kind if not identical in all particulars. Nor does glomerulo-nephritis present any stronger claims to a separate consideration, both being but varieties of acute diffuse nephritis. In the present article all will be considered under the head of acute diffuse nephritis, reserving only the acute interstitial variety—surgical kidney—for separate consideration.

ACUTE DIFFUSE NEPHRITIS.

Synonyms.—Acute tubular nephritis; acute parenchymatous nephritis; acute exudative nephritis; croupous nephritis; glomerulo-nephritis.

Definition.—Acute diffuse nephritis is that form of acute diffuse inflammation of the kidneys in which the tubular epithelium is primarily attacked and presents the most prominent morbid changes.

Etiology.—In the majority of cases of this form of nephritis scarlatina is the exciting cause. A smaller number is due to diphtheria, pneumonia, cholera, typhoid, typhus and relapsing fevers, variola, measles, erysipelas, and other forms of specific infectious disease.

Cold is the cause of a small number of cases, but whether the nephritis is excited by increased blood pressure, or partially at least by altered function dependent upon the checking of cutaneous excretion, is uncertain.

Pregnancy is responsible for quite a large number of cases. Less frequent exciting causes are extensive burns, certain diseases of the skin, acute endocarditis, articular rheumatism, pyæmia, jaundice, diabetes, etc.

Of the various poisons possessing the power of exciting the nephritic process cantharides, turpentine, phosphorus, chlorate of potash, oil of mustard, alcohol, arsenic, mercury, lead, carbolic acid and the mineral acids are the most important.

In further consideration of a few of these exciting causes it may be stated that cold is more effective when conjoined with moisture, especially if acting upon a heated surface.

Some of the infectious poisons probably exercise a specific influence upon the renal structures, and all of them are possibly irritants to these organs, which are concerned in their elimination. It is under these circumstances that the injurious influence of cold is much increased. Cold, exposure and drunkenness are a trio of causes frequently acting in unison. As to alcohol, most observers think it incapable of exciting an acute nephritis; while not accepting this view, there can be no doubt that its influence has undoubtedly been greatly exaggerated.

Morbid Anatomy.—The morbid changes occurring in the kidneys vary from those requiring the microscope for their detection to the most gross alterations, even a doubling in size of the organs. In the fully

developed lesion the capsule is tense, gapes when cut, and in rare instances has been known to rupture. If sufficient time has not elapsed to permit of a growth of connective tissue, the capsule strips from the parenchyma readily, exposing a smooth, mottled, softened, doughy tissue. The color varies according to the period of the disease and the degree of hyperæmia present, from a chocolate to a yellowish-white tint. In advanced cases the lobules are pale and surrounded by distended veins. Areas of extravasated blood may be observed upon the surface. If the organ is split longitudinally the cut surface will be stained with dark blood and hæmorrhagic foci may be numerous. The changes are most marked in the cortex, including those portions contained between the bases of the pyramids. The glomeruli are rendered prominent by intense congestion, and some may rupture with resulting distention of the urinary tubes with blood. The pyramids may appear as quite striking objects, especially if highly congested and the cortex pale. They may also be constricted near their centres by swelling of the intervening portions of cortical tissue, the resulting appearance of the pyramid having been compared to that of a sheaf of wheat.

Examination with the microscope reveals (1) changes in the tubular epithelium; (2) alterations in the glomeruli; (3) abnormal tubular contents; (4) interstitial changes.

In the earliest stage the tubular epithelium undergoes cloudy swelling; *i. e.*, becoming loaded with granular matter, causing enlargement and obscuring the details. The lumen of the tubules is narrowed and their diameter increased by the swollen cells.

In more advanced stages cellular disintegration takes place, the tubes then containing epithelial cells in various stages of granular and fatty degeneration, free granular matter, fat-drops and blood corpuscles. Many tubules are stuffed by a mass of granular desquamated cells.

Associated with this cellular and granular matter is an exudation of a fibrinous character which cements the tubular contents into a mould, which, after contraction, is separated from the wall of the tubule and may be washed out (tube casts). When the tubule is not too closely packed with cell elements and débris, the hyaline character of the exudate is apparent. The character of the entangled elements determines the character of the cast, the most important varieties being blood, epithelial, granular and hyaline casts. The epithelium of the collecting tubes undergoes little change, but these tubes may contain matter which has been washed from above by the pressure of the urine.

Marked interstitial proliferation is not considered as apparent for several months, but I have in my possession the kidneys of a young single woman who died of acute nephritis forty days after the initial chill, in which the general development of connective tissue is well marked. The attack was due to gross exposure to cold. She had pre-

viously been in excellent health, and had never suffered from any affection likely to have been followed by nephritic changes.

Various observers have found micro-organisms in the urinary tubules and malpighian tufts, more especially in connection with cases dependent upon pyæmia or diphtheria.

The glomerular changes have been studied within recent years with much care by Klebs, who has erected a special pathological form—glomerulo-nephritis—which occurs especially as a post-scarlatinal development, but the process is not limited to the acute form of nephritis. These changes have been further investigated by Langhans. The particular features of this variety are (1) proliferation of the connective tissue cells of the glomeruli, accumulation of leucocytes and sometimes extravasation; (2) increased development and proliferation of the capsular epithelium. These changes may be sufficient to compress the vesicular tuft and diminish or suppress the urine. Associated with these changes are inflammatory alterations in the tubular epithelium. The malpighian bodies may be visible to the unaided vision as minute points.

Clinical Course.—The onset of acute nephritis is variable. The symptoms which first attract attention are: (1) dropsy; (2) urinary changes; (3) gastric irritability; (4) fever; (5) pain referable to several regions, especially headache and backache; (6) anæmia; (7) palpitation, orthopnœa, and lividity, without lesions in the chest.

Active typical cases, such, for instance, as follow upon scarlatina, are ushered in by marked reduction in the quantity of the urine which is albuminous, and may be reddish, dark brownish or "smoky," from the presence of blood. The accompanying febrile movement is not excessive and seldom initiated by a rigor. The stomach is irritable and vomiting may be frequent. If œdema has not been the first symptom to attract attention, it soon appears about the eyes and becomes general. There is often a deep, aching pain in the loins, and pain may extend to the bladder, testicles, and even down the thighs. Inflammation of serous membranes may accompany full development, but more frequently uræmia supervenes more or less suddenly. More frequently the onset of the disease is insidious, a little puffiness about the eyes being the only symptom of importance present. In other cases, nausea and vomiting may appear, the patient sometimes rejecting everything taken into the stomach for days before symptoms suggestive of nephritis appear. This manner of onset I have repeatedly witnessed. In another group of cases the urine is greatly diminished, and perhaps bloody for days before dropsy or œdema or other symptoms of importance develop.

The progress of the disease is also variable, the prominent symptoms not always being the same. In some, even fatal cases, dropsy may be entirely absent, or the merest œdema present. Uræmic symptoms may appear early and violently, or the patient may, so to speak, border

upon uræmia for several days or weeks, at no time having more than headache, flashes before the eyes, a "dazed" condition, slight convulsive twitches or soporousness. According to Bristowe, all the symptoms of renal inflammation may be present, but albumin be absent from the urine. Indications of an approaching favorable termination appear in mild cases as early as the tenth to the fourteenth day; varying in well-developed cases from four to six or eight weeks. In others, a subacute state supervenes with ultimate actual, or, perhaps, apparent recovery in three to six or more months. In a small percentage the disease becomes chronic.

Urinary Condition. Frequent urination is a quite constant symptom even in the early stage. There is a good deal of urgency and the amount passed is small. The quantity excreted during the twenty-four hours is reduced, even to suppression in severe cases. Increase in the amount and lessening of the dropsy are among the first indications of improvement. The color varies, being dependent especially upon the quantity of urine voided, and upon the amount of blood present. The "smoky" color which is so common is the result of the action of the acid urine upon small amounts of blood. It may also be chocolate-colored or pinkish. Blood may appear as an early and prominent symptom, or may at no time be appreciable to the unaided eye. The amount lost is sometimes large enough to materially increase the anæmia. There is not a close relationship existing between the amount of albumin and blood in the urine.

The specific gravity is increased, but the total excretion of solids for the twenty-four hours is much lessened. In the early stage the specific gravity varies from 1020 to 1030, the gravity diminishing with increase in the quantity of the urine.

Of the important solids, urea is much reduced, usually to one-half the normal quantity, and in some instances to one-tenth or one twentieth, or even less. The quantity should be carefully estimated from day to day, as a sudden diminution indicates the approach of uræmia. The amount for the twenty-four hours must always be estimated, as the scantiness of the urine results in a relatively large amount of urea in a fractional specimen. The chlorides are also diminished and may disappear when inflammatory or other complications are present. Phosphoric acid, especially in its combination with earthy bases, is diminished. Acid urates are present in quantity, due to the highly concentrated urine, and uric acid may be precipitated. The urine is markedly acid in reaction.

The presence of albumin in large quantity is a most important symptom, and the variation in quantity offers a suggestion of value as to the patient's progress. The fact that cases of dropsy, more especially those developing after scarlatina, have been observed unattended by

albuminuria, must not be forgotten. The loss of albumin in well-developed cases is large enough to constitute a serious drain upon the blood.

The sediment is considerable in quantity in active cases, brownish in color, and consists of blood, epithelium, tube casts, a few pus corpuscles, granular débris, etc. The blood corpuscles are altered by maceration in the acid urine, appearing normal only when the hæmorrhage is fresh. The epithelium varies in form, large numbers of the small round cells from the tubuli uriniferi being present, also the elongated small-tailed cells from the pelvis of the kidney. The casts are plentiful and contain blood corpuscles, epithelium or pus cells, or all may be seen in a single cast. With the progress of the lesion the casts increase in breadth and their contents become more granular. Their numbers may be great, or diligent search may be required to find them.

The urine may remain of low specific gravity, and with but a small amount of urea, for weeks and months after recovery from the disease.

It is not unusual for the heart, especially upon the right side, to undergo rapid dilatation. This condition has been mistaken for pericardial effusion under these circumstances. Hypertrophy is less frequent. The action of the heart evidences obstruction. The galop-rhythm may be present. The blood is diminished in specific gravity from the loss of corpuscular elements and albumin.

Uræmia. This complex of symptoms appears to be more likely to develop in cases of acute Bright's disease of a distinctively secondary character—*e. g.*, such as follows upon scarlatina. It seldom appears before the urine is much decreased, although on two occasions I have observed this development in connection with a secretion but little diminished, but in each instance the patient had been subjected to unusual excitement, and in one there had been undue exertion. The duration is most variable. There may be a single convulsion or they may be repeated, even for several days, with more or less intervening coma. (See Uræmia, page 372.)

Gastro-Intestinal Symptoms. Of these, vomiting is not an infrequent symptom during the early stage, being then of a reflex nature, or it may develop at any period of the disease. Vomiting, after full development, is uræmic in character. I have seen several cases in which, without symptoms attracting attention to the nature of the disease, vomiting had been excessive for several days. The appetite is usually poor, and food-taking interfered with by reason of continuous nausea. The bowels tend to constipation.

Dropsy. Dropsy is quite a constant symptom and closely proportioned to the degree of diminution of the urine; it usually appears early and is persistent to the close. It is first noticed as a puffiness of the loose tissues about the eyes and in the conjunctivæ. A little later it

appears about the ankles and soon develops into general anasarca. In some instances it begins in the most dependent part, *e. g.*, about the hips, if lying in bed, or in the feet if the patient is moving about. The lower extremities and external genitals, as well as the abdominal walls, hips and lower portion of back, are often enormously distended. The integument may rupture and large quantities of fluid may in this manner escape. Erythema, erysipelas, or gangrene, may result, with death from sepsis. Effusion into the serous cavities may take place, particularly late in the disease, seriously interfering with the action of the lungs and heart, or with both. Ascitic accumulation is most frequent. Œdema of the lungs is not unusual, and in rare cases it may involve the glottis, tongue and neighboring structures. Inflammatory and even purulent exudates may be present in the serous cavities. With increase in the quantity of urine the dropsy diminishes.

Lungs. Bronchitis, pneumonia and pleurisy are among the events which may determine the fatal issue.

Hæmorrhages may take place, especially if the nephritis is grafted upon diphtheria, typhoid fever, variola, or other form of infectious disease. Hæmorrhages into the eyes have been observed, but are uncommon in acute nephritis.

Anæmia is gradually, indeed often very rapidly, developed, and may become a marked feature of protracted cases, but it never attains the high grade observed in chronic diffuse nephritis.

Diagnosis.—The development of a decided albuminuria, the urine also containing tube casts, blood corpuscles and tubular epithelium, a diminution in the quantity of urine, and a history of exposure to cold, or of convalescence from some infectious disease, are sufficient data for a diagnosis. The albuminuria which attends many infectious diseases must not be taken as an indication of a distinct nephritis, for it improves as the disease declines, and is not attended by dropsy, bloody urine, or any of the characteristic symptoms of an active nephritis, but the possibilities of the development of such a process under these circumstances must be remembered. It is quite common in typhoid fever, pneumonia, and in the late stages and more serious forms of many of the members of the specific infectious group.

From hæmaturia of traumatic origin it is distinguished by the history and the small amount of albumin present, which is not in excess of what can be accounted for by the amount of blood. Hæmorrhage of embolic origin is associated with valvular disease of the heart, is suddenly developed and attended by chill, vomiting, etc.

One of the most frequent difficulties is differentiation of the acute variety of diffuse nephritis from the subacute aggravations of chronic nephritis. The difficulty is greater when a satisfactory history cannot be secured. From hæmoglobinuria it is readily distinguished by absence in the latter affection of blood corpuscles, and by its paroxysmal nature.

Prognosis.—The prognosis of acute diffuse nephritis is good if efficient treatment is adopted early. But few primary cases die. Frerichs considered that two-thirds of the well-developed cases of acute nephritis recovered, which, according to my experience, is much too large a mortality. Complete recovery is more likely in young subjects. Some assume the chronic form. When occurring secondarily to septic poisoning, extensive burns, or any of the more serious forms of infectious disease, the danger is considerable. The most favorable cases are those due to cold and damp.

Death may result from œdema of the lungs, and in some cases, according to Sutton, from œdema of the stomach or intestines, causing vomiting or diarrhœa, which may precipitate collapse. It may also be due to inflammation of internal organs or hæmorrhage, but is most frequently from uræmia.

Treatment.—Perfect rest in bed should be insisted upon from the beginning of the attack. The room should be warm rather than cool, and all exposure of the surface of the body, especially to draughts of air, is to be carefully avoided. This plan preserves and increases the activity of the skin, and in corresponding degree relieves the kidneys. The bowels should in all cases be kept free, if necessary, by the use of some saline water. In the early period it is helpful to give once daily a bath at about 100° F. The temperature may be increased with advantage in some cases to 105° F. The duration of the bath should be from eight to fifteen or twenty minutes, followed by quiet rest in bed closely covered. Free sweating is to be carefully avoided in all stages, as it results in a relative increase of the excrementitious matters in the blood. Distilled water should be prescribed freely in all cases. Dry cupping of the region of the kidneys is not objectionable, and appears in some instances to be followed by good results; the cups should be applied daily or several times in the course of each day. Milk is the best form of food, and may be given plain or shaken. Buttermilk is often acceptable, and whey may be advantageously given in large quantities. If uræmia is present or imminent it is best to avoid animal food, even broth. Some well-cooked farinaceous foods are unobjectionable and afford variety. Solid food should be judiciously selected and given only in small quantities. The hot, dry air-bath may be employed to increase skin activity when uræmia is present, or the skin inactive, and for any reason it is deemed best not to employ the general bath. A tin-funnel resembling the ear-trumpet, the small extremity inserted between the blankets, which should envelop the patient, and the outer expanded portion suspended above an alcohol lamp, is convenient for this purpose and can be readily made by any tinner.

In all cases the patient should remain under observation until the albumin has entirely disappeared, and it is well to make examinations

of the urine at intervals of a few weeks during the succeeding few months, as it is not rare for the evidences of nephritis to disappear for a time, reappearing and persisting as a chronic state.

During convalescence the skin must be kept active but free from chill, the diet should be general, nutritious, and the urine kept in a bland state by the free use of water.

Aconite proves an admirable remedy in the early stage of acute diffuse nephritis, whether the case is secondary to scarlatina or to exposure to cold and damp. Its action is in the direction of control of the hyperæmia, which is such a prominent feature of this affection. It should be remembered that this remedy is indicated by the tense small pulse, cool surface, irritable stomach and anxious distressed condition occasionally met during the early days, as well as by the bounding pulse, hot skin, etc. I believe there is sometimes advantage in continuing aconite even after fully developed inflammatory change calls for another medicine, for the reason that a high degree of hyperæmia often remains a feature of the pathology after exudative and degenerative changes have developed. Twenty drops of the first decimal dilution in four ounces of water, teaspoonful doses every one to three hours, is for most cases a satisfactory dosage.

In the early stage, young children especially sometimes present indications for *belladonna* and are benefited by its administration, but it is a remedy I have not learned to trust long. *Veratrum viride*, first decimal dilution, has proven useful when the early temperature was high, the pulse small and tense, and vomiting troublesome.

The author has for years taught the superlative value of *cantharides* as a remedy for acute, subacute, and chronic diffuse nephritis. While it has been long employed by homœopathists, no one has forcibly demonstrated its value. Of late, Ringer, Lancereaux, and others of the old school have testified to its frequent usefulness. Those who give this remedy only when symptoms of bladder irritability are present, use it but infrequently, their presence, however, constitutes a strong indication. It is interesting to note that it presents in its symptomatology and pathological developments all of the essential features of diffuse nephritis. The dose appears to be of considerable importance. While I have observed good results from the use of dilutions, I prefer to give drop doses of a good tincture, from three to six or eight times in the twenty-four hours. It may be necessary to continue its administration for some time in protracted cases.

After the subsidence of the initial hyperæmia I have found *rhus toxicodendron* a useful medicine in cases not marked by dropsy. The specific action of this remedy upon epithelial surfaces and upon connective tissue led to its use. In idiopathic nephritis, in nephritis clearly attributable to exposure to cold and damp, especially when brought on by

getting wet during a cold rain, in nephritis ushered in by much pain in the back and general soreness or aching, and also in some cases following upon scarlatina without these indicating conditions, rhus has shown a marked ability to control the disease. I have frequently continued aconite with the rhus, giving two or three doses daily. As in the case of cantharides, rhus is usually most effectual when given in small doses of the tincture, *e. g.*, ten drops to four ounces of water, teaspoonful doses hourly.

Turpentine. Of this medicine I cannot speak as confidently as of either cantharides or rhus, as my experience with it has not been of such a character as to encourage me to consider it as a remedy of prime importance. Hughes, who has theories as to its value, considers its special action to be upon the circulation of the kidneys, and that scanty, bloody, albuminous urine is the special indication, it being less suitable to cases tending to uræmia. This observer thinks it more useful in nephritis dependent upon cold than when resulting from scarlatina.

Apis mellifica is a very popular remedy in this country for acute nephritis with pronounced dropsy, from which symptom it often affords relief, but it is hardly a remedy of first rank as opposed to the disease *in toto.* Searle considers apium vir. preferable to the alcoholic preparations, and that its usefulness is limited to the parenchymatous form of Bright's disease. Like apis, *arsenic* often proves useful when dropsy is the prominent symptom, but it is better suited to the subacute and chronic types, and is especially indicated when a patient grows feeble, waxy, and breathless, has an irritable, weak heart, and is much distressed, restless and anxious. The stomach may be irritable and the serous cavities contain fluid. While arsenic often acts well in the dilutions, I have been much impressed by results obtained from drop doses of Fowler's solution repeated from four to eight times during the twenty-four hours. The larger doses are apparently better suited to highly anæmic and refractory cases. When acute nephritis is persistent and tending to assume a subacute or chronic character, *mercurius corrosivus* is worthy of consideration. I have found it best suited to cases in which the dropsy has subsided or has not been a prominent feature. The patient looks wretched, is anæmic and short of breath, the urine is highly albuminous and frequently voided. Should diarrhœa with colic or tenesmus attend, the indications for this remedy are much strengthened. It is best administered in the third decimal dilution prepared with distilled water. Some observers strongly advise this remedy for the acute period of the disease, but in my own experience it has seldom been useful in cases of marked intensity.

J. G. Blackley has reported some favorable experience with *plumbum carbonicum.*

The development of uræmic symptoms calls for a general revision of the treatment, giving attention to the urine, food, bowels, skin, degree of quiet, etc. Unless contraindicated, I now administer *arsenite of copper* in the second or third decimal trituration, repeating three-grain powders every one-half to two hours until the symptoms subside. This remedy possesses a most remarkable influence over uræmic convulsions, as I have determined during the past year. In quite a number of typical cases, some of which have been observed by other practitioners to whom I have suggested its employment, its use has been followed by disappearance of the convulsions within a few hours, and this, too, in some hopeless cases of chronic interstitial nephritis. The improvement has been manifested within two to four hours in most of these cases. Prior to using the arsenite of copper I gave the *acetate* with some success, but have never observed such rapid and unequivocal action from any other remedy. *Cicuta* has helped some cases when there was twitching in individual muscles without general convulsion. The narcotics, especially *belladonna, hyoscyamus* and *stramonium*, may be called for in unusual cases. Drury strongly commended *opium*. Marcy obtained good results from *cannabis indica*, and Hughes suggests *carbolic acid* as strikingly homœopathic to uræmic coma. I know little practically of these remedies, having never observed striking results from their use. The same may be stated of *ammonium carbonicum*.

For inflammation of the serous membranes, *bryonia, cantharis, scillitin* and *mercurius corrosivus* are most important.

Œdema of the lungs is treated most successfully by *tartar emetic* and occasionally by *arsenicum* or *phosphorus*.

Œdema of the gastro-intestinal mucous membrane is benefited by *tartar emetic, arsenite of copper, arsenicum* and *veratrum album*.

In protracted cases of acute nephritis the general care and treatment is identical with that advised for chronic diffuse nephritis.

Colchicum, chelidonium, helleborus niger, sabina and *scilla*, all possess pathological and clinical evidence in their favor and may be employed when symptoms suggest.

CHRONIC DIFFUSE NEPHRITIS.

Synonyms.—Chronic parenchymatous nephritis; chronic desquamative nephritis; chronic tubular nephritis; chronic catarrhal nephritis; large white kidneys, etc.

Definition.—A distinctively inflammatory affection involving primarily the epithelium of the tubules, and secondarily the interstitial tissue, which becomes the seat of nuclear proliferation with ultimate contraction and reduction in size of the organs.

Etiology.—Fewer cases of chronic diffuse nephritis originate in the acute affection than has been generally supposed, but a few undoubtedly

arise in this manner. In some cases there is no intermission of symptoms, while in others there is apparent recovery from the acute affection for a time. Pregnancy is responsible for some, and scarlatina for more. Protracted exposure to cold and damp originates quite a percentage. Exposure of this character is most frequent in sailors and laborers who are frequently wet by cold rain while heated. Some observers attribute a special influence to dampness of the subsoil.

There is considerable difference of opinion in reference to the influence of malaria. Some, like Bartels, giving it high rank as an etiological factor, while Ralfe and others consider that the dampness of the soil rather than malarial poisoning is the cause. The same doubts exist as to the influence of alcohol. Ralfe credits beer with the power of exciting chronic diffuse nephritis. A variety of affections attended by chronic suppuration, especially tuberculosis, syphilis, and chronic abscess, have a most positive influence. The lardaceous feature is frequently associated with these cases.

The exciting agent, whatever its character may be, acts slowly and persistently, exciting the earliest changes in the tubular epithelium, which is injured in the effort at excretion.

Most cases develop between the ages of twenty and forty years. Overwork of mind and body, unhygienic conditions, and excesses of all sorts, have a predisposing influence; but after the most persistent search it must be confessed that it is often impossible to specify a cause.

Morbid Anatomy.—The anatomical appearances will depend upon the stage of the disease in which the organs are examined. Before contraction has begun the kidneys are much enlarged and present a light color—large white kidney. The surface may show a yellowish tint or be mottled. The kidneys are generally doughy, and the weight eight to ten or even twelve or more ounces each. The thin capsule is but slightly adherent and strips off a little of the parenchyma leaving a fairly smooth surface, upon which the perilobular capillaries and stellate veins are here and there distinctly outlined. Mottling is due to the juxtaposition of areas which approximate to normal, hæmorrhagic extravasations, which are not uncommon, and spots of a yellowish color.

Sections reveal great thickening of the cortex, even to two or three times the normal diameter, its light color forming a marked contrast to the dark-reddish pyramids which present a less degree of swelling.

The microscope reveals dilated tubules stuffed with epithelium in various stages of granular and fatty degeneration, and with epithelial débris and fat-drops. In some specimens many of the tubules may be filled with globules of fat recognized by a yellowish tint, and in others the fatty change may be general. Why some nephritic kidneys contain so much more fat than others is not apparent. The convoluted tubes,

especially, may be distended by desquamated epithelium, this condition being the particular cause of the thickening of the cortex. In the late stage many tubules may be emptied of their contents and remain empty. The tubules also contain casts of various sorts, especially the granular, fatty, and waxy varieties. Some may contain corpuscles. A few tubules may be observed free from dilatation or marked changes in the cellular contents.

The bloodvessels of the cortex manifest much the same alterations described as occurring in the acute variety, *i. e.*, nuclear proliferation in the capillaries of the tufts, also in the glomerular and capsular epithelium. The intima of the minute arteries, particularly that of the afferent vessels, is in a state of hyaline degeneration, their muscular coat hypertrophied, and the lumen increased as the result of obstruction incident to the changes in the glomeruli. The accumulation of cell elements around the glomeruli and the thickening of the capsule seriously impair the function of these bodies. The vessels between the tubules contain little blood, giving to the kidney its pale appearance. This is the result of compression by the distended tubules.

Under the stimulus of the continued hyperæmia the interstitial tissue undergoes hyperplasia. It also contains an albuminous exudate and leucocytes. These changes are closely related to the duration of the disease.

The malpighian pyramids present little of importance in the direction of morbid change. Their epithelium is often in some degree of granular or fatty degeneration, and waxy plugs may occupy their lumen, as well as epithelial débris from above.

If the progress of the disease is favorable the intertubular swelling diminishes, desquamated cellular elements and débris are removed, and much of the fat is possibly absorbed. The epithelium is in a measure restored by the proliferating endothelium (see author's paper Trans. Hom. State Med. Soc. of Penna., 1882, page 317), a comparative recovery thus taking place. A perfect restoration of the organs cannot result, as some degree of change in the connective tissue, tubules, minute bloodvessels and capillaries, remains permanently. In a case which practically recovered, but remained under my observation for nine years, death occurring suddenly from cerebral hæmorrhage, there was slight general enlargement of the kidneys, increase of intertubular tissue, some of the tubules contained hyaline casts, and the epithelia were slightly granular. Slight hyperplastic and atrophic changes were also manifest in many of the glomeruli.

An unfavorable course leads to continued increase of connective tissue, followed ultimately by contraction and nodulation of the organ. The capsule thickens, and when stripped from the kidney brings fragments of the parenchyma with it. The kidney retains its pale color for

a time, gradually changing to a reddish-brown if the disease is greatly protracted, section reveals a toughened organ, which may contain cysts. A fatal result is usually reached during the stage of enlargement.

The microscope exhibits tubules irregularly dilated, thickened and stuffed with degenerate epithelia and fat. Some are but little altered. The malpighian bodies are in various degrees of atrophy, some of them being converted into mere knots of fibrous tissue, surrounded by the enormously thickened capsule, while a few are approximately normal. In the advanced stage of contraction the condition cannot in all cases be discriminated with certainty from chronic interstitial nephritis if attention is limited to the morbid anatomy only. It does not, however, develop the typical granular appearance of the former affection, nor is the organ often reduced to the size of the normal kidney.

The supervention of waxy degeneration upon chronic diffuse nephritis is not uncommon. The peculiar features of this process are described in the section upon lardaceous disease of the kidney, and will not be repeated in this place. It is attributed to the protracted albuminuria, which proves a great drain upon the patient. It is recognized by the characteristic reaction developed upon the application of iodine (page 416).

Symptoms.—The symptomatology is much the same as that attending the acute variety, differing chiefly in the more insidious development, the greater prominence of anæmia, the absence from the urine of blood in quantity, and a lessened tendency to uræmia.

Dropsy is probably the symptom which most frequently leads to the detection of the disease. In the early stage it is no more than a little œdema of the loose connective tissue about the eyes, and often observed only after recumbency, or it develops about the ankles after the patient has moved about a few hours, or it may be observed in the tissues of the abdomen, oftener about the hips after recumbency, or it may appear in a hand which has been dependent, or in which the circulation has been disturbed by a little pressure. Wherever it begins the dropsy gradually increases, involving the subcutaneous tissue, first of the lower extremities and later of the body, scrotum and upper extremities. Effusions into the serous cavities occur in a few cases, usually after full development of the disease. The extent and rapidity of development depends upon the degree of activity of the renal inflammation. When the effusion is excessive, the skin suffers in its nutrition, which may result in rupture with free discharge of the accumulated fluid, or in inflammatory or gangrenous processes.

Emaciation progresses steadily, but its degree or even existence is frequently not appreciated until the disappearance of the dropsy.

Anæmia is a prominent feature in typical cases, and in association with debility may be the first development to call attention to the condition

of the patient. It is not invariably present, however, as shown by a case recently under my care at the Hahnemann Hospital, the patient dying suddenly of cerebral hæmorrhage. His previous condition had been one of cardio-vascular sclerosis associated with slight albuminuria and granular and fatty casts. The urine was voided frequently, and there was an absence of decided anæmia or dropsy. The autopsy revealed kidneys of the large white variety and the remnants of previous hæmorrhages into the brain.

The gastro-intestinal tract is usually disturbed, the appetite being poor, the tongue coated, sometimes denuded. Nausea and vomiting are common. The latter symptoms may result from catarrh of the gastric mucous membrane, from irritation of the nerve centres by retained excrementitious matters, and, therefore, uræmic in character, or to œdema of the gastric mucous membrane. In the latter form the vomited matters are often quite thin and copious. In the uræmic variety the vomiting is more apt to occur in the early morning.

Uræmia is a much less prominent feature of chronic than of acute diffuse nephritis, but if life is preserved until atrophy of the kidneys has occurred it may develop in its typical form. In the earlier period of the disease it is often associated with extreme anasarca, and more particularly when the pulmonary tissue is œdematous. The relative infrequency of uræmic manifestations is due in part, as pointed out by Bartels, to lessened development of urea and also to the relief afforded by the abstraction of so large an amount of this substance from the blood by the dropsical fluid. The various affections of the eyes, notably retinitis albuminurica and amaurosis, are seldom met before the stage of atrophy, at which period they are quite common.

The organs of the thorax are frequently involved. Œdema of the lungs and the various inflammatory affections, viz., bronchitis, pneumonia, pleurisy, pericarditis and endocarditis, are common developments of aggravated cases. Asthmatic symptoms have been observed. Effusions into the pleural sac, if rapidly developed, cause much dyspnœa.

Urine. This secretion is generally diminished from one-fourth to one-half its normal quantity. I have met with a number of well-marked cases, however, in which the amount of urine was not reduced or but slightly so. In some of these the diagnosis has been corroborated by autopsy. The amount of urine fluctuates considerably from day to day, and with the development of the stage of contraction may equal or much exceed the normal.

The specific gravity is usually subnormal, unless the quantity of urine is much reduced, when it may exceed the normal gravity by reason of its concentration. The color is variable, being generally increased. It may be lighter than normal, or of a dark-reddish or brownish color. The large amount of sedimentary matter usually present, consisting of

epithelium, tube casts, granular matter, pus cells, etc., impairs the transparency. It foams easily if shaken.

Albumin is present in large quantities in most cases. Two per cent. is not uncommon and 3 or 4 per cent. is frequently met. It is subject to marked fluctuations in quantity. The amount of albumin bears a close relationship to the severity of the disease; indeed, the progress of chronic diffuse nephritis may be fairly judged of by daily estimates of the total loss of albumin for the twenty-four hours. It is essential for this purpose to test only specimens taken from a collection for the twenty-four hours. In the late stages of the disease the loss of albumin is much diminished.

The *urinary solids*, especially urea, are reduced. It is important to remember that highly albuminous urine may have a low specific gravity due to reduction in solids.

Microscopical Appearances. The tube casts are present in abundance, and are of a most varied character. The dark broad granular variety is most common, and hardly less important are broad hyaline and waxy moulds containing a little fat or epithelial débris. In the early stage narrow hyaline casts are common. The number of casts increases with the progress of the disease, and, like the albumin, suggests its progressiveness. Leucocytes are always present, sometimes in large numbers.

Closely related to the lesion of the kidneys are the changes present in the heart and bloodvessels. These are usually coincident with contraction of the kidneys, therefore a feature of the second stage. Their nature is fully described in the section upon chronic interstitial nephritis, in association with which affection they occur so much more frequently. In the first stage the heart's impulse is enfeebled and the frequency of the pulse increased. It is compressible and often weak, but with the development of cardio-vascular changes the impulse becomes stronger, is depressed and carried somewhat to the left, suggestive of left ventricular hypertrophy. The arterial tension is also increased.

Diagnosis.—A history of acute nephritis, of exposure to cold and damp, pregnancy, some disease likely to excite a chronic nephritis, notably scarlatina, diphtheria, etc., in association with dropsy, anæmia, debility, highly albuminous and scanty urine containing broad casts of a dark granular, fatty or waxy character, constitute a group highly characteristic of the stage of enlargement. With a knowledge of such a history the diagnosis of the stage of contraction is easy, but without it one cannot always differentiate between chronic diffuse nephritis in its late stage and chronic interstitial nephritis. The smaller the quantity of urine, the greater the number and variety of casts, and the greater the amount of albumin present, as well as the lesser prominence of the cardio-vascular changes, the more likely is the condition one of chronic diffuse nephritis.

From the amyloid kidney chronic diffuse nephritis is often distinguished with difficulty. They are often associated. Conditions such as enlargement of the spleen and liver, diarrhœa and a history of a suppurative process, which together have been considered as strongly indicative of amyloid disease, have been recently shown to be not uncommon in chronic diffuse nephritis, thus limiting what have been considered as important differential features. In amyloid disease of the kidney there is less dropsy, which, as a result of the coincident involvement of the liver and spleen, is prominently abdominal. The casts are less plentiful, hyaline, fatty and smaller than in chronic diffuse nephritis. According to Senator's observations, the urine contains a larger percentage of globulin than is present in any other affection.

In cyanotic induration of the kidneys there is less albumin in the urine, which fluid is dark in color, scanty, and contains narrow hyaline casts. The attending dropsy is less severe and greater in the lower extremities and in the peritoneal cavity.

Intermittent or cyclic albuminuria can hardly be mistaken for chronic diffuse nephritis on account of the rapid fluctuations in the amount of albumin, even during a period of a few hours, and also on account of the absence of dropsy or of a degree of anæmia and debility related to the quantity of albumin; also in temporary albuminuria; according to Broadbent, the left ventricle sounds are short and weak and the apex beat feeble, while the action of the right ventricle is powerful, elevating the costal cartilages and emitting a loud sound.

Prognosis.—An unfavorable prognosis is given by nearly all observers. I have notes, however, of several perfectly typical cases which have apparently entirely recovered. Whether complete restoration of the kidney to its normal anatomical condition is ever possible in a well-developed case may well be doubted, but it must be granted that all symptoms of a kidney lesion and of ill health may disappear in some instances of chronic diffuse nephritis. Securing such a result requires not only able treatment, but intelligent and conscientious co-operation on the part of the patient, and very often the pecuniary ability to secure perfect rest or suitable changes of climate. Temporary arrest is quite common. A large percentage of all cases terminate fatally within eighteen to thirty months, and often in from six to twelve months. If succumbing to the intensity of the first stage life is not often prolonged more than from six to nine months. If the stage of contraction is reached, there may be a general improvement, which for a time encourages in the patient a hope of recovery, but dropsy is ultimately re-established, or inflammation of serous membranes, cerebral hæmorrhage, uræmia or other developments associated with the atrophic kidney, precipitate an unfavorable termination.

In the stage of enlargement, an increase in the quantity of urine, a

moderate degree of dropsy, and quantity of albumin in the urine, and a definite cause, *e. g.*, one of the specific diseases, are favorable indications. The supervention of evidences of amyloid degeneration renders the prognosis most unfavorable. Œdema of the lungs or glottis, pneumonia and pleurisy, are all dangerous complications. When occurring in syphilitics a favorable result often follows upon antisyphilitic medication, and equally good consequences result from surgical treatment of chronic suppurating foci.

Treatment.—Rest in bed is requisite during the period of greatest activity of the disease. With improvement the patient may be dressed for a portion of the day, and later, walk a little in the open air. Too long confinement favors the development of anæmia and debility; the attendant must therefore be alive to this question, treating each case in this respect upon its indications. The degree of rest required must be determined mainly by the influence of exercise upon the dropsy and quantity of albumin in the urine. If progress is not satisfactory, and the patient's finances will permit, a residence in a warm, equable climate during the cold and changeable months of the year should be recommended. Whether in bed or in the open air, the skin should be most carefully protected by wool underclothing, and its activity stimulated by means of frequent warm baths at bedtime, and during convalescence, rapid cool sponge baths each morning followed by vigorous friction.

The question of proper food for these patients has excited much discussion, with the result of an expression of most diverse views. Some recommend a milk or farinaceous diet, others an exclusion of nitrogenous food, especially of red meats, while the most recent discussions suggest the inadvisability of employing these theoretical dietaries. The observations of Hale White indicate the superiority of full over limited diet, and my experience has satisfied me of their correctness, but of the inadvisability of giving meat to many patients, or in moderate quantities. Upon full diet the urine is freer, the excretion of solid matter greater, the quantity of albumin in the urine less, and the general condition of the patient better than when a limited diet is employed. The most successful method appears to be a regulation of the food taken by the results of urinary analysis and the nutritive peculiarities of the patient. All meals should be small and frequently repeated. When fever is a marked symptom, gastro-intestinal disturbance prominent, or uræmia present, a liquid and very simple diet of a non-nitrogenous character is advisable.

For the relief of the dropsy, stimulation of the kidneys, and consequent elimination of impurities from the blood, the warm bath is most valuable. I have found this more often satisfactory than hot, dry-air baths or hot packs. They should be repeated every twenty-four to seventy-two hours, but not continued for too long a period of time.

The duration of each bath should be from ten to twenty minutes, but this may be sometimes extended to thirty minutes with advantage. The night following the employment of the bath the urine is often so much increased in quantity as to attract the patient's attention. It is not uncommon for the amount to be doubled. The temperature of the bath in the beginning should be such as to be entirely pleasurable to the patient, then gradually increased to 105° F., and occasionally to a higher point. Upon the completion of the bath the patient should be enveloped in warm blankets and kept warm, but profuse sweating is to be avoided. The frequency, duration and temperature of the bath must be determined by observation of the individual case. Judiciously employed, I have not found this agent exercising a depressing influence, quite the contrary. The hot-air bath may prove more convenient, its method of use being detailed on page 389.

The use of jaborandi or its product, pilocarpine, is very general, but results have not commended them to me. When dropsy is great and obstinately persists, it is often necessary to employ capillary drainage or diuretics, the most important being the officinal infusion of *digitalis* or *apocynum cannabinum*. If these are employed the doses should not exceed twenty to thirty minims at first. They should be repeated every three hours, the quantity taken being gradually increased until a satisfactory result is attained. A very gradual development and continuation of their influence is preferable.

In the earlier period of chronic diffuse nephritis (large white kidney) the same medicines and general treatment which were indicated for acute diffuse nephritis are applicable, particularly *cantharis* and *mercurius corrosivus*. *Cantharis* is even more valuable in this stage (which is often an advanced period of acute nephritis) than during the intense hyperæmia which marks the acute form. I have observed most positive influence over the disease in a number of cases, ultimating in apparent cure. Scanty, highly albuminous urine, micturition being frequent and painful or not, general dropsy and not much irritability of stomach, are the conditions calling for this remedy. They are the prominent symptoms of the average case. It is important to employ a good preparation, as failure is often due to inattention to this point. The lower dilutions often succeed, but I prefer the tincture administered in drop-doses and repeated from three to ten times during the twenty-four hours. It is best to begin with small doses and increase only as required.

If cantharis is insufficient *mercurius cor.* should be administered, unless good reasons exist for selecting another medicine. It appears to have less effect upon the dropsy than cantharis, but often gives admirable results after the dropsy and more acute general symptoms have subsided, the urine remaining highly albuminous and rather scanty. Anæmia, gastro-enteric or bladder irritation and a history of syphilis, emphasize

its selection. The third decimal dilution may be given in doses of one or two drops every three or four hours.

Chlorate of potash has proven of service in rapidly progressive cases with a high degree of anæmia. The patient is pale, breathless and has much palpitation. The urine is scanty, highly albuminous and may contain blood cells. This remedy is thoroughly homœopathic to the lesion of the kidneys, but for some reason has never claimed much attention as a remedy for Bright's disease. It often exercises a prompt influence over the amount of albumin and the other urinary evidences of activity of the lesion. I have employed it in triturations from the first to the third decimal.

Iodide of potassium is the remedy of first importance for cases developed upon a syphilitic soil, and should not be overlooked in any case which proves refractory, and never if a history of syphilis can be secured. If iodide of potassium appears indicated, it should not be discarded as useless until it has been given in doses of ten grains several times daily. The *chloride of gold* is often of benefit for the same class of cases, and may be considered if the former remedy fails.

Arsenic is indicated when there is much dropsy with involvement of the serous cavities, anæmia and gastro-intestinal irritation. Its administration is based in most cases upon the well-established general symptoms of this medicine, viz., restlessness, anxiety, thirst, dyspnœa, night aggravation with necessity to lie with the head high, etc. *Apis* is sometimes serviceable for the dropsy, lessens the quantity of albumin, and may favorably influence the course of the disease for a time.

Phosphorus is applicable when fatty casts appear in the urine, and there are other evidences of fatty degeneration of the kidney.

The anæmia may be of such high grade as to call for especial attention, and is then frequently benefited by *ferrum phos.*, *ferrum iod.*, *tincture of the chloride of iron, or Flint's pill* (which is based upon the composition of the blood).

With protraction of the disease and increasing interstitial changes the symptoms approximate in character to those of chronic interstitial nephritis, and require the same general treatment and medicines.

CHRONIC INTERSTITIAL NEPHRITIS.

Synonyms.—Gouty kidney; diffuse chronic interstitial nephritis; cirrhosis of the kidneys; red granular atrophy; granular degeneration; lithæmic nephritis, etc.

Definition.—The contracted kidney may constitute a late stage of chronic diffuse nephritis (secondary contraction), appearing as a pale granular organ; or, as shown by Gull and Sutton, it may follow upon arterio-capillary fibrosis, but the form here considered is a primary sclerosis of the kidneys, which is essentially an independent affection,

although it may be associated with general vascular degeneration. It appears closely related (etiologically) to emphysema, hepatic cirrhosis, endocarditis, etc., and is closely allied anatomically to the senile kidney.

Etiology.—Gout. In a large percentage of cases it is possible to relate this form of nephritis to the influence of gout, the term "gouty kidney," applied by Todd, being the most popular appellation. This form of nephritis is probably always chronic, Virchow stating that he has never met an acute nephritis which could by reason of the presence of uratic deposit be attributed to gout. Sooner or later most subjects of gout develop interstitial nephritis, due to the accumulation in the blood and excretion by the kidneys of uric acid and its compounds. This frequent association of gout with granular kidney has led to a too prevalent idea that this form of nephritis is always gouty, whereas there is no essential connection between them, many persons having normal kidneys in spite of typical attacks of gout, while others who have never manifested any symptoms of that affection die of interstitial nephritis. Uratic deposits in the terminal metatarso-phalangeal articulations are quite constant in the victims of this form of nephritis, but typical gouty manifestations are exceptional. Both, however, result from the irritant influence of uric acid.

Lead is accountable for many cases, which was first observed by Oliver among workers in lead; this observer also producing acute and subacute nephritis by the administration of large doses of that mineral. Dickinson believes that fully 50 per cent. of all workers in lead die of granular kidney, and Garrod has shown that lead poisoning favors the development of gout, that persons who have an hereditary title to gout are exceedingly susceptible to the influence of lead, and, experimentally, that lead lessens the excretion of uric acid. Whether the nephritis is the result of the direct influence of lead, or to an intermediate gout, is not determined.

Chronic alcoholism is placed at the head of the causes of this form of Bright's disease by Grainger Stewart, and Strümpell states that it is often to be regarded as the most probable cause of renal contraction, especially in persons who have lived well and have become corpulent. My personal observation is opposed to placing alcohol in so prominent a position; in truth, the influence of this agent in the production of nephritis is very generally considered to be much less important than formerly. Perhaps physiological observations which have indicated the destruction of alcohol before it reaches the kidneys have had too much influence in moulding opinion upon this subject, for alcohol, like lead, may exercise its injurious influence through the development of gout, or irritating products of some kind which injure the kidney in its attempt at excretion. The influence of this agent in the production of cirrhosis of the liver is well determined, but in its transit through the heart and lungs undoubt-

edly most of the alcohol is oxidized, and it seems highly probable that it is only in persons who use large quantities of alcohol that a sufficient amount reaches the kidneys to enable it to act with that degree of intensity required to excite degenerative changes.

I have been strongly impressed by the influence of *heredity*. Dickinson's report of eighteen cases developing in one family during three generations, with strong evidence that the disease had existed for generations before, is the most remarkable publication upon this subject. I have observed the prevalence of interstitial nephritis among the children of parents advanced in years and free from any evidence of the disease. In a family under my care for twenty years all of the children, five in number, the youngest of whom is now thirty-eight years of age, suffer from or have died of contracted kidneys. Of those who are living, one has had albuminous urine and a predominance of hyaline casts for many years and suffers from severe headaches and frequent attacks of gout; a second complains of little but headache and debility, but has had albuminuria and tube casts in his urine for several years; the third has a urine of especially light gravity, and occasional albuminuria, but few casts. This is not an extreme example.

The hurry and worry of business life, as well as *mental anxiety* developed from any cause, is an important factor. Fully two-thirds of some groups of cases have been, by different observers, attributed to this cause. This factor has been associated with lithæmia or well-defined gout in the majority of my cases.

Infectious agencies may develop cirrhotic kidneys, especially those specific to scarlatina, rheumatic fever, malaria, and syphilis. In acute infections, slight acute nephritic changes are developed which subside, but may not disappear, becoming finally established as chronic processes. The persistence is undoubtedly due to a gouty diathesis, syphilis, exposure to cold, overwork, or other unfavorable influences. As to whether the irritating factor in such instances is parasitic or chemico-toxic is not determined. Great stress is placed on syphilis as a cause of interstitial nephritis by some authors, greater indeed than seems justified by the facts within our possession. When chronic interstitial nephritis occurs in a syphilitic subject the course of both disorders is apt to be unfavorable.

Chronic obstructive heart disease gives rise to the "cyanotic kidney," a condition of passive congestion in which the organ becomes firm, deep red, or bluish, but not granular or contracted unless the process has continued for a long time, when the granulations are distinct and the organ reduced in size, but seldom below the normal.

A form met in the aged is associated with general arterio-sclerosis and is designated *senile contraction*. It appears to be the result of simple overproduction of interstitial tissue which is so generally developed in

the various tissues and organs of those in advanced life. This condition may attain such a degree as to develop albuminuria, uræmia, etc., and consequently cannot be separated clinically from true contraction of the kidneys.

The male *sex* is much more frequently attacked, different collections of cases indicating the relative number as two to one, or even four to one. This greater prevalence in men is largely due to their greater exposure to the causes of the disease. Pregnancy is less influential than in the production of the chronic diffuse form of nephritis.

Age possesses an important influence, most cases appearing between the fortieth and sixtieth years, a much less number developing during the preceding and succeeding decades. The marked reduction in the number of cases after sixty is opposed to the old idea, which regarded this form of nephritis as a disease of the aged; it belongs rather to late middle life. The late Dr. Oatley and myself made autopsies upon two cases in young persons, seven and nine years of age respectively, in which the kidneys were typically cirrhotic. The frequency of this form of Bright's disease in children is greater than we have until recently supposed, probably for the reason that more attention has of late been directed to post-mortem examinations in children.

Cold and *damp*. As in chronic diffuse nephritis a residence upon cold and damp soil favors the development of the interstitial variety, but in less degree. Strümpell thinks the disease more prevalent upon the cold coast region of Germany, and Purdy attributes an influence to our cold, moist northeast region. Ralfe considers that much of the influence attributed to the malarial poison is due to a cold and damp soil. That malaria produces some cases is undoubted, also that others are due to the combined influence of cold and malaria.

Digestive disorders occupy quite a close relationship to interstitial nephritis. The frequency with which dyspepsia is attended by deposits of urates and oxalates in the urine suggests the probable mode of action, but it is doubtful whether the renal changes are due to the direct action of the abnormal blood or the constant passage through these organs of separated products. The known influence of oxalate of lime in setting up catarrh of the renal passages is indicative of the probability that the same agent may also develop changes within the tubules and surrounding tissues. Saundby considers the excessive ingestion of animal food an important factor.

Inflammation of the urinary passages by extension leads to the development of a small number of cases. Such inflammation is of the nature of chronic cystitis or pyelitis, subsequent to gonorrhœa or excited by calculi. The gross appearances in these cases are not typical.

Morbid Anatomy.—The small, red, granular, cystic kidney is one of the most characteristic objects in pathological anatomy. The external

appearance may present a considerable variation from the typical organ, *e.g.*, the kidney may have a grayish color instead of a reddish brown; or, it may be a little larger than normal, at least not reduced in size, and of a reddish hue (the large red kidney), which probably represents an early stage of some cases before contraction has taken place. Even when much reduced in size there is an abnormal amount of fat about the organs. In typical contraction both kidneys are atrophied in about the same degree, representing two-thirds, one-half, or even much less of their normal bulk, and weighing together seven or eight ounces. A feature equally as striking as the reduction in the size of the kidney is its granular surface, which is more conspicuous after the removal of the capsule. The granulations vary in size from a mere point to that of a pea, and when small they may not be apparent before the removal of the capsule. A third quite constant macroscopic feature of prominence is the cysts, which may be present in large numbers and vary in size from a pin's head to a walnut, and, like the granulations, may require the removal of the capsule to reveal the smaller ones. They may be entirely absent. When the capsule is torn off, which is often accomplished with difficulty, it brings with it portions of the parenchyma. The capsule is opaque, much thickened, and its vessels and lymph channels dilated, the result of obstruction within the organ forcing return blood to emerge by way of the capsule. The organ has a dense feel, and incisions indicate toughness. Examination of the granulations reveals the fact that they are uniformly small, the larger ones being made up of several. The depressed portions, about the granulations, are of a deeper color.

Section of the kidney reveals great atrophy of the cortex, which in extreme contraction is reduced to even one to three millimetres in thickness. The malpighian bodies are diminished in size, many have disappeared, but owing to thickening, the small arteries are more conspicuous.

The microscope reveals great increase of the intertubular *connective tissue*, much of the normal structure of the kidney being replaced by fibrous tissue. The appearance of the new tissue varies from that of a homogeneous basement matter in that recently developed, to a well fibrillated structure in the oldest areas. The youngest tissue contains many round and stellate connective tissue cells. A study of the atrophic malpighian bodies exhibits a variety of appearances depending upon the stage of degeneration. Early, there is an increase in the nuclei of this body, which is soon transformed into a cellular mass. Further changes in the loop may be in the nature of a fibrous or hyaline transformation. The capsules are thickened and surrounded by laminated bands of fibrous tissue; in some the contents may undergo colloid degeneration with the formation of cysts. Sections vertical to the surface of the kidney show that the process develops from without inward.

Bloodvessels. The larger bloodvessels are dilated and thickened, the

latter being dependent in most cases upon changes in the muscular and external connective tissue coats. The muscular layer is thickened by a process of true hyperplasia. A cellular growth developing in the intima leads to narrowing of the lumen and actual obstruction (*endarteritis obliterans*). The hypertrophy of the muscular layer, which has attracted so much attention, was first well described by Dr. George Johnson in 1867, this observer demonstrating that the change was not limited to the kidneys, but affected also the arterial system in general. It is important to mention that, although not accepted to day, the observations of Gull and Sutton, already referred to, were supposed to teach that the changes in the renal bloodvessels were but a part of a general process—arterio-capillary fibrosis—in fact, that the general development of this change might exist in the vessels, the kidneys remaining free. These observers also taught that the vascular changes were the result of unknown causes and not due to imperfect excretion by the kidneys. In opposition to this position, and more nearly consonant with modern pathology, is the view of Johnson, which attributes the mural changes to the stimulating influence of blood containing an irritant having its origin in defective excretion by the kidneys. This irritant first excites contraction of the minute vessels and then overgrowth of their walls, the associated hypertrophy of the left ventricle being due to an effort on the part of that organ to overcome the vascular obstruction.

Changes in the tubules. Many of the tubules are entirely obliterated by the pressure of the connective tissue, others are reduced in size, and still others are irregularly dilated. The tubular contents vary in character, depending largely upon the stage of degeneration of the epithelial contents; they may consist of granular cells only, when there is little change; the epithelia being cloudy, granular and somewhat fatty. In many of the tubules the epithelial cells appear flattened, as if atrophic. Many tubules are entirely denuded of their epithelial lining. Hyaline casts are observed here and there. Cysts originate in dilated tubules, and also in the beginnings of tubules, viz., the capsules of the malpighian tufts. The basement membrane swells, appears hyaline, merging with the newly formed connective tissue, or is converted into a cyst wall.

It is not uncommon to observe deposits of partially crystalline sodium urate, which may be obtained within the tubules, and, according to Garrod, in the fibrous tissue. It appears as white lines and dots.

The pelvis of the kidney may be reduced in size by the contraction of this organ, or it may be enlarged and the calyces elongated by reason of retraction of the pyramids.

To discriminate between the small red granular kidney of chronic interstitial nephritis and the shrunken kidney, which is a consequence of chronic diffuse nephritis, is often difficult, sometimes impossible without the aid of a well-defined clinical history. This is for the reason that

atypical forms are not uncommon, *e. g.*, secondary contraction may proceed very slowly, with removal of the fat, and the development of a reddish-gray color; or, the kidney of interstitial nephritis may be altered by acute inflammation, with the result of a change from the typical red to a grayish or yellowish color, the result of fatty change. We are helped also by the fact that the secondarily contracted kidney is never finely granular like that of interstitial nephritis, but has coarse granulations, or more often is lobulated.

Clinical Course.—Interstitial nephritis is marked by obscurity in its early stages; in truth, it may remain completely hidden until the development of symptoms of an immediately serious character. Attention may be called to its presence by a great variety of groups of symptoms, viz., convulsions or coma (uræmia), cerebral hæmorrhage, persistent headache, vertigo, disorders of vision or of hearing, epistaxis or hæmorrhage from any of the mucous surfaces, progressive prostration and failure in flesh, asthmatic symptoms, palpitation, bronchitis, vomiting, diarrhœa, œdema about the eyes or ankles, general pruritus, renal colic, sciatica or other deep neuralgia, slow convalescence from acute disease, etc., any of which may first direct attention to analysis of the urine and to discovery of disease of the kidneys. Not infrequently autopsy discloses chronic interstitial nephritis in persons who during life presented no symptoms calling attention to the existence of renal disease.

The most important of the symptoms of interstitial nephritis are associated with the urine. In typical cases the amount is increased, pale, very clear, of a low specific gravity, of decidedly acid reaction and usually albuminous. The amount of albumin varies considerably. Especially in the early stage of the disease it may be absent for considerable periods of time. Some observers state that the disease may run its full course without albuminuria. I have observed cases for several years without the appearance of albumin in the urine, although frequent examinations were made, but in each albumin has been finally detected. It is quite possible that statements referring to this point are made by those who do not observe great delicacy in chemical manipulation, or who have followed the cases reported for too short a period of time. Late in the disease attacks of intercurrent acute nephritis may lead to the presence of quantities of albumin in the urine. It also appears after the breakdown of the hypertrophied heart. The rapid development of a marked albuminuria in the course of this form of nephritis is suggestive of a complication. Under no circumstances does the amount of albumin present equal that which attends other forms of nephritis. The quantity of urine excreted in the twenty-four hours is nearly always increased. During the early stage I have observed considerable fluctuation in quantity, the urine remaining normal for several days, then being excessive for one or more days, but in general the polyuria is a constant

symptom until the period of cardiac failure, when the amount of urine is decreased to or below normal. An increased quantity is suggested by the very common habit these patients acquire of rising at night to urinate. In respect to this symptom, however, it must not be forgotten that occasional urination at night is not uncommon in those who sleep poorly, take freely of alcoholics, abuse tobacco or have some form of disease of the bladder.

The specific gravity is lowered, usually to about 1010; occasionally it is 1006 or 1007, and exceptionally it is little above that of distilled water. In the later stages of the diseases when the quantity of the urine is diminished, there is a proportional increase in its density, 1030 to 1025 being not unusual.

The urea is diminished from the beginning of the disease. There are but few exceptions. This decrease is both absolute and relative. The early decrease is seldom less than one-third of the normal amount, *i. e.*, to 2 per cent., but with full development, and in the later stages the reduction is frequently to 1 per cent. or less. Bartels, Stewart and others have observed cases without diminution of the urea.

Other urinary solids suffer considerable change, particularly the phosphates, which are greatly diminished, their marked reduction being considered as having some diagnostic significance. The amount of chlorides is little altered.

The quantity of uric acid excreted is much diminished, especially late in the disease (Frerichs). This substance and the oxalate of lime often appears in crystalline form. Both may be observed in the same specimen of urine. The precipitation of uric acid is believed to be in part due to the lessened amount of pigment matter in the urine, although there is frequently an excessive development, especially in the early period of the disease.

The sediment is slight, but may be considerably increased after circulatory failure. It is increased by intercurrent disturbances. Very few cellular elements are visible.

Tube casts are usually found if a thorough search is made, but they are few in number, possess but slight refracting power and are easily overlooked except by an expert with the microscope. Their distinguishing character is the relative absence of entangled epithelium or of epithelial débris—in other words, it is their hyaline structure. Most are of a narrow calibre and may contain a little granular matter or a few fine oil-drops. Occasionally one is met containing a degenerated epithelial cell or a fragment of such a cell, or the cast may be a typical fine granular mould. With intercurrent acute nephritis numbers of granular casts may appear; even blood casts or free blood corpuscles may be present in the urine.

There is a strong disposition to the development of acute inflamma-

tion in the course of chronic interstitial nephritis, such attacks being excited by acute disease of some character, especially the infectious forms, also by impaired digestion with free excretion of oxalate of lime or uric acid crystals, this variety being frequently associated with catarrh of the genito-urinary tract, and by exposure to cold or abuse of some kind. Under these circumstances the specific gravity of the urine is increased, its quantity is diminished, and there may be a pronounced sediment.

Changes in the circulatory organs appear early in most cases, and it is a practical point of great importance that the existence of contracting kidneys is frequently suspected by reason of the presence of hypertrophy of the left ventricle and a pulse of high tension. The evidence of the hypertrophy is an increase of percussion dulness to the left and especially downward. One judges that the arterial tension is abnormally high when unusual force is required to compress or obliterate the pulse, and when during the periods between the beats the vessel does not seem to have emptied itself, but is still felt as a rounded cord which may be rolled under the finger. This condition may or may not be associated with alterations in the vessel wall, which is determined by cutting off the supply of blood by means of pressure above, when, if the vessel is approximately normal in structure, the empty tube will collapse upon pressure.

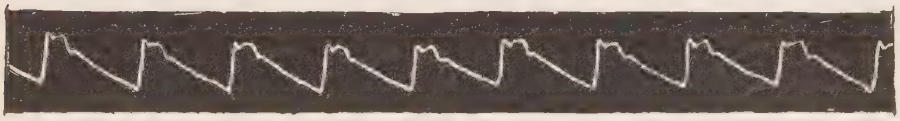


FIG. 53.—HIGH TENSION PULSE FROM CASE OF CONTRACTED KIDNEY.

The first sound of the heart may be doubled, owing to a lack of synchronism in the action of the ventricles. Both of the heart sounds are abnormally accentuated. Dyspnœa and palpitation may attend. With failure of the hypertrophied heart there are reduction of the arterial tension, development of dropsy, especially in the lower extremities, and the urinary features which have been already described. It is not rare for heart murmurs to be associated with the contracting kidney. They may be due to acute endocarditis, to dilatation of the left ventricle, or be left over from some previous affection. Atheromatous degeneration at the aortic valve may give rise to direct or indirect murmurs.

Beside the cerebral form of hæmorrhage which is so common in this form of nephritis, hæmorrhages may occur into the eye or from any of the mucous surfaces.

In some degree albuminuric retinitis and uræmic amaurosis are present in nearly all cases. They develop much more frequently and

at an earlier period of the disease than in chronic diffuse nephritis. In the latter affection they seldom appear before the stage of atrophy.

Disturbances of the nervous system (uræmia) occur more frequently in interstitial nephritis than in any other variety of disease of the kidneys, being the mode of death in nearly all cases which have run their course, and occurring frequently in the earlier stages of the disease as an acute manifestation. The development is variable. It may be in the form of some of the minor and less troublesome symptoms, or suddenly as convulsions and coma. Of the less serious manifestations, headache, drowsiness, restlessness, asthma, nausea and vomiting, twitching of the muscles, general pruritus, general neuralgic pains, etc., may be mentioned.

Anæmia is not as prominent a symptom as in chronic diffuse nephritis. Rosenstein observed the corpuscles reduced to 3,000,000. I think this is low even for most cases in which anæmia is well marked. The hæmoglobin is correspondingly reduced. The amount of urea in the blood is increased four- or five-fold.

Disturbances of digestion may constitute a prominent feature in any period of the disease. The appetite frequently fails early. Vomiting as a symptom of uræmia is most apt to take place when the stomach is empty, with ejection of an alkaline fluid, or it may be dependent upon gastric catarrh, which in some cases may be secondary to an associated cirrhosis of the liver (Murchison).

There may be attacks of oppressed breathing not unlike typical asthma. These attacks are prone to develop during the night, continue a few hours and then disappear. A certain amount of dyspnœa may exist during the day.

The patient frequently looks pale, although it is often a matter of surprise that so good a color and so large an amount of adipose tissue is retained. The integument is dry, the tendency to perspiration being very slight. An obstinate eczema, but more frequently a troublesome degree of general pruritus may develop.

The duration of interstitial nephritis is exceedingly variable. It is often impossible to determine its duration in a given case on account of the impossibility of assigning a date of origin, as we have seen that it may exist for years before discovery. A few cases run a comparatively rapid course, *i. e.*, the patient dies within two or three years, while others may exist for six, ten or more years.

Diagnosis.—There is usually no difficulty in distinguishing the presence of interstitial nephritis after the disease is well developed. At this time, with thorough examination, about the only question that can arise is as to whether the contracted kidneys are of the primary form or secondary to chronic diffuse nephritis. From the large white kidney interstitial nephritis is easily distinguished; the former affection being

more frequent under middle life, is much more rapid in its development, is attended by general dropsy, and very seldom by uræmia, hæmorrhage, or albuminuric retinitis; the urine is scanty, contains quantities of albumin, is of high specific gravity and broad, granular, waxy and hyaline casts.

Lardaceous disease of the kidney may resemble interstitial nephritis when, as is frequently the case, the urine is abundant, pale, of low specific gravity, contains a minute amount of albumin and a few casts which are essentially hyaline in character; but in lardaceous nephritis there is an absence of hypertrophy of the left ventricle, a history of protracted suppuration, or of syphilis, and other organs may also manifest waxy change.

In nervous persons, especially women, the urine may have a low gravity persisting for weeks and months. The general symptoms may also suggest kidney disease, but there is an absence of albumin and of casts in the urine and the normal gravity is finally restored.

The frequency with which interstitial nephritis develops in men during the middle period of life justifies frequent examinations of the urine in this class, in order to detect the first evidences of its existence or of conditions which act etiologically. It is therefore wise to advise business and professional men, after the arrival of middle life, to have urinary analyses made at least once annually.

Prognosis.—Interstitial nephritis, at the stage in which it is usually discovered, is incurable, but if detected early, preventive measures may be adopted with some prospect of arresting the progress of the disease and of prolonging life. Those who come under treatment while the general nutrition is good, complaining of some impairment of vigor and in whose urine there is little or no albumin, and, more important, but a moderate reduction in the percentage of solids, frequently regain and retain for many years the general evidences of good health. Under a rigid treatment a similar result may be attained even in more advanced periods of the disease. Little can be hoped for after the development of uræmia, though even then some patients improve for some time, and if the secreting structure of the kidneys is not too much reduced the patient may go on for some time in a fairly comfortable condition. The possible development of uræmia, cerebral hæmorrhage and other serious so-called complications, should not be forgotten.

The general progress of the disease is much affected by its associations. When connected with syphilis, tuberculosis, lead poisoning or extended cirrhotic changes, a fatal result may take place before a high degree of contraction has developed; when caused by gout, the evolution of the disease is slow and its course exceedingly chronic.

Treatment.—The incurability of chronic interstitial nephritis has been asserted. By this I mean that the disease in the majority of cases

progresses more or less steadily to a fatal termination, and that in all cases the pathological changes which have taken place are permanent. Treatment cannot remove the new growth of connective tissue nor restore the atrophied gland, but much can be accomplished in the direction of arrest of the lesion, and if a sufficient amount of functionally active kidney structure remains, life may be indefinitely prolonged.

The several items of treatment which are of especial importance relate to general habits of eating, drinking, dressing, resting and to climate, rather than to the use of medicinal agents.

When the patient's finances will permit, active occupation should cease and a residence in a dry and warm climate be selected. In our own country the winter months may be spent in the South, especially in southern Georgia and Florida, or better, in southern California. But wherever one resides, it is important that the house should stand upon a dry soil and be so constructed as to avoid dampness of its walls. The clothing should be of woolen goods, and proper weights should be worn both summer and winter, night and day. The skin should receive a great deal of attention, warm baths being given at bedtime twice weekly, and in many instances a cool sponge-bath each morning. The patient should live in the open air as much as possible, exercise moderately and upon level ground. Nothing tends to greater injury than imprudent exercise, and no item of treatment is more frequently followed by marked improvement than a period of complete rest. Equally important is abstemiousness in the matter of diet. The free use of red meat, sugar, starch, cheese, and alcoholics, should be prohibited. Of meats, sweetbreads, liver, bacon, tripe, white meat of fowl, and fish, are to be especially commended. Milk, cream, butter, eggs, vegetables and fruits are admissible. Under ordinary circumstances tea, chocolate in its various forms, and coffee may be allowed.

Water should be taken freely and in the purest form procurable. If there is any uncertainty as to the character of the drinking water some of the lithia waters, or, best of all, distilled water may be advised. It is important to determine that the water is properly distilled and free from unpleasant taste.

A milk diet sometimes proves useful and acceptable, especially during the acute exacerbations, but in general the urine is found to contain more albumin, a smaller percentage of urea, and the general condition is less favorable than when under a more liberal diet.

The subject of rest requires further consideration. Complete rest in bed with plain, scanty diet, gentle massage, and plenty of water, often revolutionize the condition of the patient, improving nutrition, lessening vascular tension and quieting the hypertrophied heart. The indications for such a period of rest are the occurrence of intercurrent acute or subacute nephritis, the development of dropsy, increase in the amount

of albumin, dyspnœa, progressiveness of the disease in spite of careful treatment, or the appearance of symptoms of approaching uræmia.

It is important in all cases to pay attention to the bowels as constipation is prejudicial in high degree.

The physician should keep in mind that while within certain limits medicines accomplish much in this form of nephritis, they are of small consequence as compared with the general measures which have been detailed. This caution is demanded by the common practice of over-medication while neglecting the more efficient physiological measures. Again, it is a common error to prescribe only for the contracting lesion of the kidney; while certain medicines exercise an important influence over the connective tissue changes in progress, it is more important to search out a possible lithæmia, oxaluria, syphilis, or nutritive errors of some form, and address treatment more directly to these conditions which may act as causative factors. The great variety of disorders having a bearing upon this disease increases correspondingly the number of available remedies and methods required for the treatment of chronic interstitial nephritis, only a few of which it is possible to notice.

Chloride of gold is a remedy of great value if given in the early stage of the disease. I have notes of quite a number of cases treated for considerable periods of time with this medicine, in which there has been more or less approximation of the urine and of the patient to the healthy standard, even after the urine had been copious, pale, albuminous in some, and with marked reduction of urea and the presence of tube casts. It is of great value for the treatment of the very early symptoms. There are quite a large number of the cases of chronic interstitial nephritis which present symptoms for a long period before the urine gives evidence of the disease which is within the reach of the ordinary observer. These patients have dyspeptic symptoms, weakness, etc., with little of a suspicious character in the condition of the urine, unless the centrifuge is employed, when tube casts will be quite regularly found. This is the stage in which to most successfully treat interstitial nephritis, and the period of the disease when the chloride of gold is most valuable. It is suggested by copious clear urine, firm pulse, possibly slight dyspnœa or palpitation, and a variety of digestive and nervous symptoms. These patients may be thought to be neurasthenic. The dose may consist of ten drops of the second decimal dilution, repeated two to four times daily, and can be gradually increased to twenty drops, in some cases, with advantage. Triturations, pellets, etc., deteriorate rapidly. This medicine may be administered for months, resuming its use as soon as possible after any intercurrent remedy.

Iodide of potassium is highly recommended by many clinicians for its action upon the renal and associated lesions, as well as on account of its ability to reduce the arterial tension, which is so important a feature of

some cases. Delafield thinks its favorable action due to the prevalence of undiagnosticated syphilis. A careful study of its symptoms will often suggest it as a remedy.

Plumbum. Hughes's original recommendation of plumbum was a good one, as it is an excellent simile of the disease in its totality. But clinical evidence of its value, if we except a case or two, has not been forthcoming. Possibly lead is so generally distributed, being taken into the bodies of so many in small doses that it often fails to act when given as medicine. The dependence of the contracting kidney upon the action of lead has been referred to. I have made some use of the *iodide of lead* in the lower triturations and feel encouraged to continue observations.

Mercurius corrosivus is also valuable in some cases of the interstitial form of nephritis. It is particularly suited to cases dependent upon syphilis. It has appeared to me to be helpful for the periods of acute aggravation indicated by considerable albuminuria with associated symptoms of an acute character. *Mercurius viv.* 3x is recommended by C. Mitchell when the nephritis is due to lead poisoning; also *mercurius iod.* when the former is unsuccessful.

Nitro-glycerin. This agent is much employed for the increased arterial tension. In drop doses of a 1 per cent. solution it softens the pulse, diminishes the excessive urine and lessens albumin. There can be no doubt as to its value in many cases. In the first decimal dilution it has relieved uræmic headache with tense pulse.

Intercurrent attacks of acute nephritis demand the same remedies as the primary form. *Aconite* is particularly valuable, acting favorably upon the hyperæmia of the kidney and upon the tense circulation, restlessness, etc. It is often well followed by *mercurius cor.*

Phosphoric acid is often successful in mitigating excessive urination, day and night, rapid failure in flesh and sense of mental and physical exhaustion. It suits feeble neurotic patients best with an absence of marked arterial tension best. I have had the best results from the persistent use of the first decimal dilution.

Jousset advises *arsenic* as being indicated by the thirst, debility, emaciation and urinary symptoms. While this medicine often relieves symptoms and is of decided value, it is not a remedy of the first class for interstitial nephritis.

Jousset and others recommend *nux vomica* for the stomach symptoms, and through its action upon the digestion, is of no inconsiderable value.

Lithium carb. and *lithium benzoate* are prominent remedies when gout is the cause.

The severe headaches attending some cases are usually due to high arterial tension, and if not controlled by aconite, belladonna, cuprum, cuprum ars., iodide of potash, etc., the 1 per cent. solution of nitro-glycerin should be given, drop doses one to three hours until relieved.

In order to meet the various symptoms of the disease it will be necessary to consult many sections, especially those upon gastric catarrh, arterial affections, cerebral hæmorrhage, etc.

LARDACEOUS DISEASE OF THE KIDNEYS.

Synonyms.—Amyloid, waxy, albuminoid, or hyaline degeneration of the kidney.

Etiology.—While it has not been definitely settled whether lardaceous disease of the kidneys is of the nature of an infiltration or a metamorphosis, its characteristics certainly closely ally it to the infiltrations, and it may be tentatively so considered. Again, some authors do not regard it as a form of Bright's disease, but treat it as a separate affection, which view appears to be justified by the fact that, while it is frequently associated with nephritis, it also appears as a distinct and separate affection. The principal reason for the recognition of the lardaceous kidney as a form of Bright's disease is the frequent association of this change with diffuse inflammation of these organs, whereas the same change occurring in the spleen and liver is not so attended.

Lardaceous disease is in most cases dependent upon protracted suppuration and has therefore developed as a sequence of chronic disease of bone, pulmonary phthisis, chronic bronchitis with dilated tubes, ulceration of the intestines, syphilis, carcinoma, malaria, persistent albuminuria, and other affections involving long-continued loss of albumin. It cannot be stated that age or sex possesses any special influence upon its development. Most cases appear between the twentieth and fiftieth years of age, for it is during this period that the affections likely to excite lardaceous disease are common. In a few cases nothing can be learned as to the cause, although Sutton states that he knows nothing of it as an idiopathic affection.

The frequent association of the lardaceous change with chronic diffuse nephritis has led to much discussion as to which is the primary affection. Johnson propounded the theory of the secondary development of the lardaceous change, it being dependent upon the drain incident to the great loss of albumin, but further observations appear to support the position of Bartels, viz., that both are dependent upon one and the same cause.

Morbid Anatomy.—The appearances are most variable, being affected by the extent of the lardaceous change as well as by the form and stage of the associated nephritis. Both organs are involved, but not in the same degree. In the early stage the microscope and staining fluid are necessary for its detection. It must be remembered that the early stage of lardaceous change may exist with advanced forms of nephritis, therefore proper tests should be applied in all cases examined. The associated nephritic changes may be of the tubular or cirrhotic varieties.

The kidneys are generally considerably enlarged, even doubled in size. In a case of Johnson's the pair weighed twenty-eight ounces. They may present a peculiar blotched purplish-red appearance (Sutton), with here and there yellowish, shiny areas. The surface may be pale and smooth. The capsule is easily stripped. Section reveals a thickened, waxy, shining cortex, which is firm and brittle. The medullary portion is often congested and presents a sharp contrast in color to the lighter cortex. The characteristic reaction with iodine giving a mahogany brown, is much more satisfactorily employed when applied to sections for examination with the microscope. With this instrument the kidney tissue appears infiltrated with a granular matter, giving to it a hazy appearance. In the early stage the microscope may be required for the discovery of the waxy change which begins in the bloodvessels. A little later the glomeruli may be detected without this aid as grayish points which assume a peculiar brownish color upon the application of iodine. In a small pecentage of lardaceous kidneys the organs are reduced in size and present much the general appearance of interstitial nephritis, even the presence of numerous cysts and an adherent capsule. Greater reaction would undoubtedly result were it not for the presence of the waxy infiltrate. The progress of these cases is exceedingly slow.

When the lardaceous change is well established, sections of the kidney are peculiarly translucent, the condition being instantly apparent to the trained microscopist. In the earliest stage, however, the alterations are confined to the malpighian tufts, which present a shiny, waxy appearance. In many the change may be confined to a portion or to portions only of the tubules. With progress of the disease the larger bloodvessels are attacked; in the walls of the minute arteries the change, according to Cornil, beginning in the tunica intima, which view is in opposition to the long entertained one that the muscular tunic is the one primarily involved. But in whichever layer the infiltration is first apparent the circular muscular fibres ultimately become plump and outlined with great distinctness. With involvement of the general capillaries of the cortex tubular changes appear, the waxy matter forming moulds of the urinary tubules (waxy casts). A careful study of the observations of able observers, and some personal experience, suggest that the composition of the tubular exudate is not the same in all instances, for in well-developed lardaceous disease all casts do not respond to the iodine or aniline-violet tests. Grainger Stewart claims that the matter entering into their composition does not present the translucency peculiar to lardaceous matter, but corresponds precisely to that forming hyaline tube casts. The reaction tests, as applied to casts, cannot therefore be relied upon for diagnostic purposes. As to infiltration of the basement membrane and epithelium of the tubules there is considerable difference of opinion, but the weight of evidence is strongly

in support of such infiltration. Axel Key advocates the origin of the casts in fusion of the infiltrated tubular epithelium. The cells acquire a translucent appearance, are swollen, and may lose their outline as the result of amalgamation. Fat molecules may finally appear, and with destruction of the cells, fat appears in a free state in the urine.

The development of intertubular connective tissue progresses slowly, appearing in the more chronic cases as broad bands of hypernucleated tissue. Cysts are seldom numerous. Dependent upon the same influence as the renal lesion are the enlarged liver and spleen, and the lardaceous degeneration of the vessels of the gastro-intestinal tract, with the resulting gastro-intestinal symptoms.

The complications are the same as in chronic diffuse and interstitial nephritis.

Symptoms.—There is greater discrepancy in the statements of different authors regarding the urinary features of this affection than respecting that of any other form of renal disease, which is in considerable measure due to its almost constant association with other lesions, and these presenting considerable variety. The quantity of urine is generally stated to be much increased, while some excellent observers, such as E. Wagner, have found it generally diminished, except during short periods, when it may exceed the normal. Undoubtedly, as pointed out by Fagge, these diverse opinions are the result of the recognition of many cases as lardaceous in character which other investigators would class as chronic diffuse nephritis. Wagner and Fagge both claim to have observed the lardaceous kidney more frequently than either the chronic diffuse or chronic interstitial forms of nephritis, which indicates, if correct, that a large number of cases of nephritis generally considered to be of the chronic diffuse varieties are in reality examples of the waxy form, which explains the statements in reference to quantity. In the cases I have observed the amount has varied from less than normal to sixty-four ounces. In one instance the amount rose to ninety-six ounces. The specific gravity is influenced by the amount excreted, and varies from 1003 to some point above normal. In the late stage the amount is decidedly diminished. Micturition is frequent. The color is usually lighter than normal.

Albumin is quite constantly present and usually in large quantities. Cohnheim and others have reported cases without albuminuria. By Esbach's method five to eight grammes to the litre is not an unusual amount. The statement that the albumin is due to the associated nephritis has not been proven, but rather that it is a positive feature of the lardaceous change. Globulin is frequently present in larger quantity than serum-albumin. Sediment is scanty.

Tube casts are at first few in number. If the amount of urine is large they are few and are essentially hyaline or faintly granular; when

plenty, well-marked broad, waxy, fatty and granular casts of the dark variety are observed. There is little epithelium unless the condition is a mixed one. Free fat-drops may be present.

Solids. The excretion of urea is but little interfered with, the slight diminution appearing to be the result of insufficient production.

Dropsy is a marked symptom, but not often as prominent a feature as of chronic diffuse nephritis. It usually begins as œdema of the feet, which for a time may disappear after recumbency. It soon becomes general, the serous sacs being not infrequently involved. As in chronic diffuse nephritis, the dropsy may invade the lung parenchyma, proving a most serious complication. When lardaceous disease is associated with chronic interstitial changes, dropsy does not appear until late and then in the lower extremities. It is due to failure of heart power.

Uræmia is infrequent, due to the free secretion of urine with its large percentage of urea, and the general dropsy, this fluid withdrawing from the circulation a large amount of excrementitious matter. Dropsy may be entirely absent, especially in cases marked by diarrhœa.

Changes in the eyes and cardiac hypertrophy are uncommon.

General Appearance. A waxy complexion is common, and according to Grainger Stewart, there may be a varicose appearance of the minute bloodvessels upon the cheeks, and a deposit of pigment about the eyes. A pale anæmic look and puffy countenance are common.

Anæmia, debility, breathlessness, palpitation and indisposition to exertion are proportioned largely to the rapidity of development of the disease. The tongue is usually coated, digestion impaired, and diarrhœa may attend. A careful study will show that in most cases the symptoms approximate either to the chronic diffuse or chronic interstitial varieties of nephritis.

The course of the disease is usually exceedingly chronic, the fatal issue being determined mainly by the accompanying lesions. When associated with nephritic changes it seems highly probable that the combined affection should prove more rapidly fatal than either alone, and statistics appear to support this supposition.

Diagnosis.—The recognition of lardaceous disease of the kidneys is usually difficult, often impossible. It most frequently resembles chronic diffuse nephritis, from which it is difficult to distinguish it. The cases attended with least doubt are clearly related to protracted suppuration or syphilis, and are associated with the evidences of waxy change in the liver, spleen, and less frequently in the alimentary tract. According to Fagge, in his excellent article upon this subject, "neither the characters of the urine nor any other symptoms can be relied on to suggest its real nature," and it may be said that even the association of enlargement of the spleen and liver with suggestive urinary symptoms, do not prove the renal change to be lardaceous; and further, that diffuse lardaceous

disease of the spleen as well as the sago-spleen (infiltration of the malpighian follicles) may exist with physical evidences of their enlargement, yet we cannot be certain of the nature of the renal lesion. While dependence cannot be placed upon urinary characters, those of most importance in differentiating from chronic diffuse nephritis are large quantity, scanty sediment, lesser number of casts, and cell elements.

Prognosis.—This is unfavorable, some questioning whether a cure ever results, and yet life is often indefinitely prolonged. The most likely cases are those supervening upon syphilis or disease of bone or other removable primary affection.

The duration is exceedingly variable, depending upon many circumstances. Progress is rapid in feeble individuals suffering from serious disease, in persons poorly fed, housed and environed, and in hot countries. Death seldom results directly from the lardaceous change in the kidneys, but rather from the general debility incident to extensive lardaceous changes in the various organs, associated with profuse suppuration, diarrhœa, etc.

Treatment.—It is particularly important to direct active treatment to the exciting cause of the disease. This may be effectual when the primary point is removable, as in the case of diseased bone, scrofulous glands or syphilitic lesions. Aside from this the treatment must be conducted as for chronic diffuse or chronic interstitial nephritis, according as the case resembles one or the other of these affections. A nutritious diet and highly supporting treatment is especially important, and of medicines *mercury, iodide of potassium, biniodide of mercury, iodide of arsenic, hepar sulphur, hydriodic acid, chloride of gold* and *nitric* and *phosphoric acids* have given the best results.

No remedy has given better results than hydriodic acid, best given in the form of the syrup, teaspoonful doses several times daily. It is peculiarly helpful in cases developing upon tuberculosis, especially of the glands. For highly anæmic cases the syrup of the iodide of iron is most valuable; also the blood salts as extracted and prepared for administration by O'Conner's method.

PERINEPHRITIS.

Perinephritis is an inflammatory process affecting the tissue in which the kidneys are imbedded.

Etiology —It may be the result of extension from the renal system or from other tissues less intimately associated with the perirenal structures, from infections, and finally from direct injury.

When the inflammatory process spreads from the renal organs it may have its origin in the pelvis of the kidney (pyelitis); in the kidney structure (suppurative nephritis or tuberculosis of the kidney); or in the ureter (ureteritis).

Of extensions from more distant parts, inflammation having its origin in appendicitis, abscess of the liver or spleen, pelvic cellulitis, or which follows upon affections of the rectum and uterine adnexa, psoas abscess and Pott's disease, are the most important.

Cases due to infection may develop in the course of smallpox, typhoid or typhus fever and scarlatina.

Direct injury resulting in perinephric abscess may be in the nature of strains, blows or stabs.

Perinephritis appears to be more common in women than in men, and Ralfe attributes statements as to its infrequency in children to the fact that it is often overlooked in young subjects due to the pus working downward and resembling psoas abscess or hip disease.

Morbid Anatomy.—The involved tissues undergo the several changes peculiar to the inflammatory process, with a strong tendency to terminate in suppuration. There may be multiple purulent foci which finally unite forming an abscess of large size. From contiguity to the bowel the pus may have a distinctly fæcal odor. If the abscess is due to sepsis the pus has a diminished consistency and a grayish tint. There may be shreds of gangrenous tissue, and I have observed a case in which hæmorrhage occurred into the abscess. The character of the walls of the abscess will depend much upon its duration, rapidly progressive abscesses having ragged walls, those of protracted ones being smooth. The condition of the kidney is governed by the size of the abscess, but more particularly by the extent to which it is enveloped by the suppurative process. It may present small abscesses beneath the capsule, or the entire organ may be softened and its epithelium in a state of cloudy swelling.

Symptoms.—The symptoms are essentially those of deep-seated abscess in any portion of the body. The development may be insidious with deep-seated pain in the region of the kidney. There may be a chill, followed by fever of a continued or intermitting type. Rigors may be repeated. With the progress of the inflammation the pain increases, often becoming severe, and may be aggravated by pressure. There is a tendency to radiation from the renal region towards the groins or hypogastrium. With the accumulation of pus there is fulness and increased resistance in the lumbar region. The fulness may increase until a tumor is formed, the integument covering it becoming œdematous, red, hot, tender and fluctuating. Less frequently the abscess burrows forward to the iliac fossa pointing above Poupart's ligament. Less fortunate extensions are upward, with perforation of the diaphragm and development of some form of inflammation in the chest; or it may perforate the peritoneum with resulting peritonitis, or the stomach, bowels or bladder. The rapidity of development of the abscess is variable, evidences of a purulent accumulation being present within six or eight days in most cases, while others may continue for weeks before there is evidence of

suppuration Before there is a distinct protrusion the part may be best examined by placing one hand below the border of the ribs posteriorly, the other being employed to palpate the anterior surface. With full development of the abscess a well-marked tumor occupies the space between the ribs and the iliac crest. The patient is disposed to stand with the body inclined to the affected side, with the hips slightly flexed and the hand of that side resting upon the thigh (Gibney). While in recumbency the thigh upon the side of the inflammation is preserved in a state of flexion, thus relaxing the abdominal muscles of that side. The rectus muscle overlying the tumor is rigid.

Urinary changes are only present when the kidney has been primarily or becomes secondarily involved.

The continued pain, fever and, often, gastric irritability impair nutrition, with consequent failure of strength and increasing emaciation.

Diagnosis.—Pyonephrosis, hydronephrosis, spinal caries, and lumbago involving one side, are conditions which simulate perinephritis. When the disease is upon the right side and quite acute, it presents points of similarity to typhoid fever and appendicitis, but the formation of a tumor in the lumbar region, the absence of gurgling in the iliac fossa, and the location of the severe pain, are sufficiently diagnostic. Careful localization of the tumor is an important element in the diagnosis, not only in its relation to the two diseases just mentioned, but in connection with differentiation from tumors of the liver and spleen, and from carious disease of the spine. The febrile symptoms and general acute character of the case separate perinephritis from hydronephrosis, fæcal accumulation, lumbago, carcinomatous and other renal tumors. The position assumed by the patient while standing has been referred to, and it may be further stated that this feature may be developed before a tumor is detected.

Prognosis.—A successful issue depends much upon the cause and upon the condition of the patient's general health at the time of the attack. After the formation of an abscess recovery must be rare without evacuation of the pus by way of external tissues, although in one of my cases the abscess evidently opened into the duodenum and continued to discharge rather periodically for about one year, followed by recovery.

The most favorable direction for the pus to take is through the tissues of the lumbar region.

Treatment.—While surgical treatment is of first importance, demanding that the abscess should be drained at the earliest moment, much may be accomplished in the early stage by rest, light diet and the careful administration of the well-known remedies for abscess, the most important in the early stage being *belladonna*, *hepar sulphur*, *rhus toxicodendron* and *arnica*, being governed in their selection by cause, symptoms and pathological state.

Fomentations and poultices are of assistance in controlling the severe pain. It is important in the beginning of the attack that the bowels should be well cleared. A free saline purge is of undoubted value for the same reasons that have been advanced by many for their use in peritonitis.

PYELITIS.

Pyelitis is an acute or chronic inflammation of the pelvis of the kidney.

It is ordinarily spoken of as an inflammation of the pelvis of the kidney, but instances must be rare in which the inflammatory process does not involve the ureter in some degree, and often it is but a part of a general catarrhal process affecting the entire genito-urinary tract.

Etiology.—The development of a primary pyelitis may be due to cold, exposure to cold and wet, and to the influence of many of the specific infectious diseases, especially typhoid fever, typhus, the typhoid stage of cholera, diphtheria, variola, influenza and measles. Tuberculosis excites a most obstinate form. It may also develop in the course of scurvy. It may follow upon the irritant action of cantharis, turpentine, various balsams, and the excessive use of diuretics. The secondary form, which is by far the most common, results from the presence of foreign bodies, especially calculi, blood clots, or morbid growths such as hydatids, or tuberculous masses in the pelvis of the kidney, resulting in obstruction to the outflow of urine. Lesions causing interference with the normal discharge of the urine frequently involve the male urethra (stricture). Hypertrophy of the prostate gland often leads to the disease in old men, and other lesions of this gland may be operative in younger persons. Gonorrhœa or cystitis accounts for some cases by extension. In spinal disease with paraplegia the mucous membrane of the entire urinary tract is altered in its nutrition, tending strongly to the development of catarrhal inflammation. Pyelitis may also develop in gouty or lithæmic persons from the presence of irritating crystals in the urine. When associated with purpura, scurvy and high grades of anæmia, free hæmorrhages into the pelvis of the kidney may take place repeatedly.

Morbid Anatomy.—In the early stage of the disease the mucous membrane is hyperæmic, swollen and covered with a muco-purulent secretion. There may be ecchymoses here and there, and the mucous membrane undergoes destructive changes, with the result of freeing the peculiar epithelia of the deeper layers of the mucous membrane which have been erroneously considered as characteristic of pyelitis when found in the urine. With the progress of the lesion the tissues of the pelvis of the kidney undergo thickening, and the mucous membrane loses color, becoming of a "slate gray" or "ashy" tint. In primary cases due to infectious diseases the kidney may be attacked, with the development of

numerous foci of suppuration (pyelonephritis). If there is obstruction, the calyces are gradually dilated and the papillæ flattened. Under the continued stimulus of pressure the renal parenchyma wastes until the organ with its capsule is transformed into the walls of a large abscess. Obstruction may develop suddenly from impaction of calculi, blood clots, fragments of kidney structure, or pieces of morbid growth; or, gradually, from progressive thickening of the tissues. The rate of progress of kidney degeneration is, of course, dependent upon the degree of completeness of the obstruction. When the pressure is slowly increased a connective tissue hyperplasia is excited in the kidney, which enables this organ to longer withstand the ill effects of the distention. The destructive changes in the early stage are most marked in the pyramids, which bodies by reason of their position are exposed to the highest degree of pressure; ultimately the cortex is also reduced and may largely or quite disappear. The tumor which results from obstruction may undergo a variety of changes. The purulent collection may be absorbed, followed by shrinkage of the mass, or the contents are reduced to a semi-solid consistence; or, finally, rupture of the sac may take place into the tissues about the organ, through the walls of adjacent hollow organs, or rarely, the pus may burst into the peritoneal cavity or through the diaphragm into the chest. More frequently it follows the psoas muscles to Scarpa's triangle. The contents of the abscess cavity consist of urine, pus, mucus, calculi, fragments of kidney structure, and sometimes portions of morbid growths.

Symptoms.—In the most acute form, with involvement of the kidney in the inflammatory process, the general symptoms are of a serious character, viz., chills, high temperature, sweats, lumbar pains and gastro-intestinal disturbance. In some cases, even of an acute type, the condition is an obscure one. The local symptoms consist of tenderness, pain, which may be of a dull or acute character and located in the region of the kidney or along the ureter; and if there is obstruction of the ureter a tumor is developed which generally may be readily palpated.

The urine presents the most important features of the disease. The quantity is little changed, the specific gravity is somewhat above normal, varying from 1024 to 1028 or 1030. The reaction is alkaline, but it may be acid in the early stage. The urine is turbid, depositing a sediment which is at times large and which the microscope shows is composed of pus, epithelium, and occasionally blood. Crystals of uric acid or oxalate of lime are frequently present. Following Ebstein, the presence in the urine of epithelial cells supposed to be peculiar to the deeper layers of the mucous membrane of the renal pelvis, has been considered the most important feature of pyelitis. Investigations by Creedon, corroborated by Porter, of New York, have demonstrated that these cells do not possess a peculiar morphological character separating them from cells found

in the deeper layers of the mucous membrane of other portions of the urinary tract. Some years since, while teaching histology, I made an investigation of this subject which resulted in much the same conclusion, and have since taught that while single and double-tailed epithelial cells are often present in large numbers in the urine of persons suffering from pyelitis, that the presence of such cells is not proof of the existence of that affection.

Albumin is seldom present in amount without coexisting nephritis, the little there is being dependent upon pus and blood. Blood in small quantity may be due to associated acute nephritis or the irritant influence of calculi. With great increase of the pus the peculiar epithelial cells are obscured and not as readily discovered.

Temporary obstruction, when the disease is limited to one side, will result in clear urine for a time. With the progress of alkaline fermentation pus cells are disintegrated with resulting opacity of the urine. Bacteria, crystals of ammonio-magnesium phosphate, are abundant. Micturition is frequent, particularly when the bladder is involved, and strangury is not uncommon. Frequent painful urination may exist when the bladder is unaffected, and even in the early stage of pyelitis, as the result of reflex action.

Diagnosis.—If the case is observed during its early period, and the purulent urine is found to be persistently acid, and there is an absence of positive symptoms of bladder involvement, it is safe to consider that the pelvis of the kidney is the part attacked, the side being often indicated by localized pain, tenderness, etc. Much stress is laid upon the intermitting flow of purulent urine, but as a practical fact, this symptom is not often available, nor is the character of the epithelium present in the urine of positive value, indicating only that the deeper layers of the mucous membrane are involved, but not the location of the lesion.

It must be confessed that in many cases the diagnosis is, at least for a time, difficult or impossible.

In catarrh of the bladder the urine is muco-purulent, deposits a glairy sediment, is ammoniacal, and there are marked symptoms of vesical irritability. Cystitis and pyelitis often coexist. When, with symptoms suggestive of pyelitis, the amount of pus associated with the glairy sediment is larger than that attending cystitis; also when the symptoms indicative of bladder irritation are well marked, the existence of both may be assumed.

The tumor of pyonephrosis is differentiated from hydatid and malignant disease by the presence of fever, purulent urine or a history of its presence. In a case of aggravated catarrh of the pelvis of the kidney and bladder under my care some years since, the exciting cause was perforation of the bladder by pus discharged from an abscess resulting from appendicitis.

It is important to determine whether the pyelitis is primary or secondary. This is judged of by the history of the development of the symptoms. In secondary pyelitis the disease usually arises by an extension upward from the mucous membrane of the lower urinary tract and is attended in the early stage by symptoms relating to the urethra or bladder. The urine is alkaline in reaction (at least neutral) and undergoes decomposition, while in primary pyelitis some of the causes of that affection, which have been detailed, are found to have been operative. There is usually an absence of painful and frequent micturition, and the urine may remain acid during the early days. This latter distinction, however, cannot be fully relied upon, as primary pyelitis may undoubtedly be attended in some instances by reflex irritability of the bladder.

Treatment.—In acute cases the patient should be put at rest in bed. If pain is a marked feature some relief may be secured from the use of hot poultices, fomentations, dry cups, and hot foot-baths. A general warm bath every twenty-four hours is often of use in the early stage. The urine should be rendered unirritating by the free use of demulcent drinks. Alkaline waters often prove useful. Milk is the best article of food. Everything of a stimulating character should be avoided. In chronic forms the same measures are in some degree applicable, *i. e.*, rest, production of copious bland urine, and a simple, unirritating diet.

When obstruction is the cause, it is of first importance to effect a removal of the constriction, or of the foreign body which fills the ureter. The former is accomplished by general measures and medicines, the latter by surgical interference. Statistics illustrate the importance of not delaying operative treatment too long. Before advising operation it is important to determine as far as possible the condition of the other kidney, as it is diseased in quite a percentage. If disease is apparently limited to one organ, or the evidence of disease of the other kidney is slight and the urine contains a fair amount of urea (upon repeated examinations), it is probably advisable to operate. In several cases attended by very painful urination I have seen good results from perineal section.

The employment of the solvent influence of drugs upon calculi is advised, and may be at times a wise thing to attempt. If the stone consists of uric acid or oxalate of lime, the alkaline carbonates may be employed, especially the acetate or citrate of potassium; and for phosphatic calculi, the mineral acids, are most used.

J. H. McClelland recommends aspiration or cutting down upon the cyst wall through the loin, followed by drainage and washing of the cyst with solution of iodine, carbolic acid, or calendula (20 per cent.), in distilled water.

Removal of the kidney is demanded in some instances and may be successfully performed.

Medicinal agents are of decided value, especially when it is possible to remove the exciting cause of the disease, the accomplishment of this indication not always resulting in restoration. Medicines are also necessary to antagonize certain diathetic states which tend to a reproduction of the cause, *e. g.*, the uric acid diathesis. With the advent of fever, pain, and purulent urine, *aconite* is often useful, especially in primary cases. According to symptoms, cause, etc., *belladonna*, *rhus tox.*, *bryonia*, *cantharis*, or *cannabis sativa* may be called for.

For their influence directly upon the lesion of the mucous membrane, after the catarrh has become established, *buchu*, *chimophila*, *hydrastis*, *mercury*, especially the *merc. cor.*, *pareira brava*, *pulsatilla*, *sulphur*, and *uva ursi* have all been employed and are recommended by different observers. Hughes considers the latter medicine the most important one.

I have never given any remedy from which I have witnessed such decided results as from *boric acid* in ten-grain doses, repeated several times daily. Symptoms growing out of the great loss of pus may be antagonized by *cinchona*, *chininum ars.*, *arsenic* or *quinine*.

For calculous cases *benzoic acid*, *benzoate of sodium*, *lithium carb.*, *lycopodium* and *sarsaparilla* may be employed.

Piperazin in two-grain doses, several times daily, has been of use when the disease was kept up by the irritant action of uric acid crystals.

If ammoniacal decomposition has produced a putrid urine which does not yield to ordinary remedies and irrigation of the bladder, we may adopt Andrew Smith's suggestion of giving *saccharin* in three-grain doses, repeated three times daily. This substance is powerfully antiseptic and acts as an acid in the urine. This observer claims that it may be given for months without the slightest irritating influence. *Benzoic acid* in ten-grain doses possesses much the same influence. The bowels must be kept open, which can usually be accomplished by the use of some of the alkaline spring waters if required.

SUPPURATIVE INTERSTITIAL NEPHRITIS.

Synonyms.—Surgical kidney; obstructive nephritis; pyelo-nephritis; ascending nephritis; puerperal kidney.

The term "interstitial" is selected for the reason that the inflammatory process has its origin in the connective tissue of the kidney, and the word "suppurative" to distinguish this affection from chronic interstitial nephritis, in which disease there is no tendency to purulent accumulations. This form of inflammation of the kidneys possesses close relationship to Bright's disease, and yet upon close study will be discovered to present marked etiological and symptomatic differences.

Etiology.—Bacteria possess an important relationship to this variety of renal inflammation, securing an entrance to the kidneys by way of the mucous membrane of the genito-urinary passages, by the bloodvessels, and possibly also through the lymphatic channels.

Some form of obstruction to the flow of urine, leading to detention and decomposition of this fluid, is the most frequent cause of suppurative interstitial nephritis. Such obstruction may be due to the presence of a calculus in the pelvis of the kidney, or its impaction in the ureter, its presence in the bladder, or to stricture of the urethra. The process may be excited by the presence of stone within the renal structures. It may follow upon inflammatory changes resulting from catheterism, enlargement of the prostate gland, tumors of the ovaries and uterus, pelvic inflammations, pregnancy, indeed any condition which may obstruct the outflow of urine.

Injuries in the nature of blows, kicks, or stabs involving the kidney or its immediate neighborhood, have all been known to excite suppurative action within the kidneys, although traumatism ranks among the rarer causes. The embolic process accounts for a few cases, the emboli having their origin in acute septic endocarditis. When originating in this manner the renal vessels may sometimes be found filled with masses of bacteria. The septic organisms may also have their origin in septicæmia, pyæmia, dysentery, diphtheria, typhoid fever, actinomycosis, etc. In suppurative nephritis dependent upon pulmonary disease the elastic fibres of the lung tissue have been found in the renal abscesses, thus demonstrating the source of the emboli (Boettcher).

It is possible for the kidney lesion to develop by extension of disease processes from neighboring structures, *e. g.*, caries of the vertebræ and abscess of the liver, spleen or psoas muscle.

The disease occurs much more frequently in men, probably in the proportion of six to one. Few cases occur before middle life.

Morbid Anatomy.—The general features of the morbid change will depend in some degree upon the cause of the individual case. If, for instance, it is secondary to septic endocarditis, or to septicæmia, both kidneys are apt to be uniformly involved. When secondary to inflammation of the genito-urinary mucous membrane, one kidney is usually attacked, and in the traumatic form the changes are extensive, the surrounding tissues being involved and a large portion of the organ ultimately destroyed.

The kidneys are usually somewhat enlarged, the capsule is thickened, in some degree adherent, and the surface of the organ red and granular, but more frequently pale. Section sometimes reveals thickening, at other times thinning, of the cortex. The pelvis of the kidney is dilated, baggy, and usually contains purulent urine. The mucous membrane is vascular and may be œdematous. Upon removal of the capsule, particles of the parenchyma are found adherent, each bit of tissue which has been torn off from the cortex indicating the location of a minute abscess. These punctate abscesses are found singly or in groups, and it is interesting to note, in the early stage, that they may be con-

fined to areas of tissue in relation to the bases of certain pyramids. In many of the cases, at least, the inflammatory process first attacks the papillæ of certain pyramids, the infective process travelling along their structure to the base of the organ. With full development of the disease the minute foci unite to form larger abscesses, thus leading to destruction of considerable tracts of tissue.

Lines of purulent foci corresponding to urinary tubules are found, upon microscopic examination, to involve the inter-tubular tissue.

The convoluted tubules may exhibit slight changes peculiar to nephritis. Some may be choked with leucocytes. Most of these tubules are of normal size, but the straight tubes are dilated and contain casts. It is not uncommon to observe the renal epithelium desquamated by the action of the invading leucocytes.

The bloodvessels exhibit the changes peculiar to *endarteritis obliterans*. The muscular coat and adventitia are thickened. The bloodvessels contain a good deal of blood. Many of the glomeruli are apparently normal, others are in a state of nuclear proliferation, and, later, they undergo hyaline degeneration. Blood is often found surrounding the tufts.

The connective tissue is swollen, and here and there contains inflammatory foci, the tissue being filled with migrating leucocytes. In the more advanced foci all the conditions of abscess are present.

It is not uncommon for abscesses to break through the papillæ of the pyramids, the pus flowing through the calyces into the pelvis of the kidney. The pyramid is gradually destroyed. It is not uncommon, in the late stages of the disease, for the kidney to be partitioned into several purulent sacs, or the entire organ may be converted into one large abscess. These changes are usually further advanced in one kidney. The pelvis of the kidney and the ureter may be dilated, sometimes greatly so. Both are seats of purulent catarrh.

Symptoms.—Apart from the urinary characteristics the symptoms of obstructive nephritis are frequently very indefinite, and those which exist are often complicated with the developments of a primary affection. Local symptoms are often prominent, at other times quite absent. Pain may be severe, but oftener consists of simple aching in the region of the kidneys, involving one or both. The pain may be localized in the region of the kidney or may radiate through the abdomen to the groins, etc. The pain may be localized at some point along the ureter, suggesting impaction of the tube with a calculus, clots or fragments of kidney structure. The pain may be constant or paroxysmal. When obstruction exists there is swelling above the obstructed point, a distinct tumor being sometimes discoverable deep in the hypochondriac region resulting from dilatation of the pelvis of the kidney.

Urine. The most important feature of the urine is the presence of

pus. Blood may exist in visible quantity and can be nearly always detected by the use of the microscope. In well-developed chronic cases the urine is much increased in quantity, amounting to sixty, eighty or more ounces in the twenty-four hours. The specific gravity is low. In most cases the urine is diminished in quantity, still presenting a low specific gravity due to the small amount of urea. The decrease in quantity bears a close relationship to the extent of the destruction of renal substance and may amount to an almost entire suppression. The reaction is usually acid, but with the development of associated catarrh the urine undergoes decomposition, developing alkalinity. The same condition gives rise to turbidity and a deposit of muco-pus. Pus originating in the kidney or in the pelvis of the kidney does not present the glairiness which is peculiar to bladder pus. The amount of pus in the urine is variable. It may require the microscope for its detection, or represent one-quarter of the bulk of a single passage of urine. The amount of pus is also subject to sudden fluctuations, a free discharge representing rupture of an abscess or the sudden removal of an obstruction to its discharge. Such obstruction may be due to a calculus or to a bit of renal tissue. I have been able to secure fragments of such tissue more certainly by passing the pus through a fine sieve or not too fine cloth, by the aid of flowing water.

Albumin is invariably present, but never in excessive quantity, the amount being governed largely by that of the pus or the blood in the urine. The few cases which present a free albuminuria are attended by an unusual degree of diffuse degeneration of the kidneys.

Tube casts are very scanty and of the hyaline or granular kind. It is not rare to meet a blood cast. Micro-organisms are abundant, and triple phosphates may be present. It is not unusual for protracted cases to develop an acute nephritis. Such attacks are characterized by the same changes in the urine as attend the primary form.

Fever is not a constant symptom and in some cases may be entirely absent. The pulse is increased in frequency in proportion to the height of the temperature and the feebleness of the patient. Chills, followed by elevated temperature and sweats, may occur at intervals, and are dependent upon the formation of abscesses. Ralfe states that he has observed attacks beginning with well-marked rigors sufficiently severe to simulate paroxysms of ague.

With the progress of the disease emaciation is often rapid, the patient complains much of gastric irritability, even of vomiting and diarrhœa. With failure of the vital forces, the tongue becomes dry and brown, the pulse rapid and weak, and there may be slight delirium and a good deal of sweating.

The heart is sometimes considerably hypertrophied. Dropsy seldom attends except as a result of intercurrent acute nephritis, or a failure in the heart's ability.

Uræmia in its typical character is an unusual symptom, but is not infrequent in the form developing in pregnant women. It is usually of typhoid type, but, according to Senator, it may resemble diabetic coma.

Diagnosis.—The diagnosis of suppurative nephritis is frequently made only after thorough and repeated examinations, including analyses of the urine. Its existence may be suspected when the patient is the subject of genito-urinary disease, or has received an injury in the region of the kidneys attended by hæmaturia, purulent urine, and tenderness or tumor in the region of one or both kidneys. When the disease develops insidiously it presents strong resemblances to intermitting fever, pyæmia, typhoid fever, septic peritonitis, or perirenal abscess, but in all cases the most important information is developed by thorough examination of the urine. The characteristic urinary conditions are often associated with evidences of hypertrophied heart, high arterial tension, accentuation of the aortic second sound at the base, and sometimes reduplication of the first sound at the apex.

Prognosis.—The post-mortem table has revealed so many scarred kidneys that we are forced to believe that some cases at least practically recover. There is too much of a tendency to treat cases of suppurative nephritis as if hopeless, which must necessarily influence the treatment unfavorably. Many cases, by means of judicious treatment, may have life prolonged, and a very few pass into comparative health, but it must be confessed that but few make even this partial recovery after the lesion is well developed, and for obvious reasons. The most favorable cases are those due to an obstruction which is removable. The rapid improvement which sometimes takes place may be due to lessening of coexisting pyelitis or pyelo-cystitis.

Treatment.—It is of first importance to endeavor to overcome the condition which has determined the existence of the renal inflammation. The frequent impossibility of accomplishing this is the great cause of so high a mortality. For a consideration of the various causes of obstruction and their management reference must be made to special works upon the genito-urinary system. While the treatment of the primary disease is being conducted, the patient's strength must be supported by proper rest, diet and often stimulants.

Medicines which possess the greatest influence over the suppurative process occurring in the kidney are mercury in its various forms, especially *mercurius corrosivus*, which is particularly called for if there is an associated strangury, or *hepar sulphur* if the amount of pus from the kidney is large. *Sulphur* proves useful in the course of most long-continued cases, its prescription being based upon the general symptoms rather than upon the condition of the urine or local symptoms. *Benzoic acid* or *benzoate of ammonium* should be considered if the urine has a strong ammoniacal odor and the subject is gouty or rheumatic. Syphilitics may require *iodide of potassium.*

When associated with a septic condition *arsenicum, crotalus, carbolic acid, chininum ars., baptisia* and *lachesis* should be studied.

If catarrh of the pelvis or of the bladder attends, much benefit follows its treatment. It is not uncommon for the most annoying symptoms to be due to coexisting conditions.

The remedies for the several forms of nephritis, for pyelitis, and for pyonephrosis, may be consulted with advantage.

RENAL TUBERCULOSIS.

Under the head of tuberculosis of the kidney are included all those lesions the development of which is associated with the presence of the bacillus tuberculosis. These lesions are represented by the development of tubercles and by "strumous inflammation" of the parenchyma of the organ. They are attended by constitutional disturbance, changes in the urine, particularly a deposit of caseous débris, and the development of a tumor in the renal region.

Etiology and Morbid Anatomy.—Aside from its association with tuberculosis in other portions of the body, we know little of the causation of renal tuberculosis. Why the kidney should be attacked is seldom apparent. Its development seems to be associated with hereditary influence, defective environment, cold, certain diseases, etc. It occurs more frequently in young persons, even children, than in those who have attained middle life, and men are much more frequently attacked than women. The development is usually bilateral, although much more advanced in one organ. In the course of tubercular disease in various portions of the body a greater or less eruption of tubercles takes place in the kidney, particularly during the latter stages of the disease. This general bilateral miliary development is to be distinguished from the pronounced local tuberculosis of the kidneys which involves one organ especially, and is associated with tubercular growths in other portions of the genito-urinary tract. In these latter cases it is more than probable that the bacillus enters the urinary tract by way of its mucous membrane. The point of first attack is variable. It is usually in the kidneys, involving either the pyramids or the cortex. The development may be from the pelvis of the kidney. The tuberculous masses when first observed are usually yellow and caseous. They gradually enlarge, forming masses of considerable size, coalesce and then break down with resulting abscesses and sinuses, and ultimately discharge into the renal pelvis. The tubercular masses which develop in the mucous membrane of the pelvis of the kidney, also ultimately break down, with the formation of ulcers having a ragged appearance. Similar lesions may affect the ureter, which may be sufficiently thickened to result in interference with the outflow of urine. Obstruction is more frequently dependent upon plugging of the tube by tubercular débris or coagula of

blood. When the obstruction is complete the retained urine and tubercular products distend the pelvis with a resulting pyonephrosis. The destruction of renal tissue may proceed to an almost complete removal of the gland, the kidney with the pelvis being converted into a large tubercular abscess. In some instances enough tissue may remain standing, and is rendered firmer by connective changes, to wall off a number of abscess cavities, the interior of which may become lined with a tolerably smooth wall. These cavities may contain tubercular débris which is reduced to the consistency of putty, or which may contain a quantity of lime salts or cholesterin. The capsule of the kidney may be dense and much thickened. When the cortex is involved the kidney is enlarged, may have a lobular surface and areas of tubercular infiltration within the gland corresponding to the prominences upon the surface. It is not uncommon for the renal structure which remains to undergo amyloid degeneration. A nephritis is often developed in the remaining kidney. Careful investigation shows that the disease first involves the stroma and that but little evidence of inflammation appears within the tubules, although they undergo compression and are obstructed by granular matter.

The bladder is often attacked, the tubercular growth beginning in the submucous tissue and eventuating in open ulceration. The urethra may be involved by extension, also the prostate gland and seminal vesicles. The pelvic organs of women are less often attacked.

Changes in the epididymis, testicles and prostate gland are still less common.

Symptoms.—These differ considerably according to the extent of the disease. In well-developed cases involving a considerable portion of the tract, the symptoms are essentially those of pyelo-cystitis. If the nodules are small, and especially if not located on a free surface, symptoms may be few or absent. The urine is usually acid, unless the bladder is involved with resulting catarrhal inflammation. The most important urinary feature is the presence of a sediment which may be copious and composed of pus, débris of tubercle including the bacillus tuberculosis, epithelium from the deeper layers of the mucous membrane, portions of renal parenchyma, especially connective tissue. There is a stage when sediment is absent, and another when it varies in amount from time to time. Blood is not constantly present, nor often in large amount. If the opposite kidney is healthy, the solids may be about normal in quantity. If cystitis coexists, the urine contains much glairy purulent deposit, and urination is painful and frequent. Tube casts may be present and the urine pale and of low gravity if nephritis is developed in the remaining kidney.

Fever, which is the most important of the general symptoms, is rarely absent. It follows much the course of the fever attending tuber-

cular deposits in other organs, *i. e.*, it is marked by daily aggravations, which are usually in the evening, followed in the morning by a normal or subnormal temperature. Paroxysms of an intermitting type are not uncommon. There is progressive loss of flesh and strength. The patient may have sweats. Unlike the failure attending pulmonary tuberculosis, it may be manifested in the nervous realm late in the course of the disease, as the result of uræmic infection, a common condition when both kidneys are involved.

The local symptoms are rather negative. Pain and tenderness over the kidney region are common. The pain may occur in paroxysms. It may be possible to detect a tumor should hydro- or pyonephrosis develop. It is possible in some instances to palpate the diseased ureter and walls of the bladder.

The disease is a progressive one, always proving fatal after it has attained a degree of development warranting a diagnosis. It is seldom that life is prolonged more than two years, and many succumb within a few months. The fatal result is usually due to general exhaustion, which is in considerable degree a result of the free suppuration. Death often results from coexisting tuberculosis of other organs.

Diagnosis.—The obscurity which has surrounded the diagnosis of tuberculosis of the kidney has been removed by the researches of Koch, and we are now able in most instances to promptly determine its existence by the presence of the specific bacillus in the urine, which organism should be looked for in all doubtful cases; and while it gives no evidence as to the extent and location of the process, it furnishes positive proof that some portion of the urinary tract is involved. Its absence, however, does not exclude tuberculosis. The lungs and other possible locations of tuberculous lesions should be examined. The existence of a hereditary predisposition, and of tuberculosis in other members of the same family (thus favoring infection), are of some value in forming an opinion.

Prognosis.—The prognosis is unfavorable, and very positively so when the lesion is widely extended, the urinary being but part of a general process. Were it possible to make a diagnosis sufficiently early the diseased organ should be removed, and with some prospect of a favorable result.

Treatment.—The general treatment should be the same as for pulmonary tuberculosis, and local measures will be governed by the same principles laid down for the treatment of pyonephritis and pyocystitis. As previously suggested, the question of extirpation of the organ arises in cases which are diagnosticated while the lesion is limited to parts which permit of removal.

HYDRONEPHROSIS.

This term indicates a dilatation of the renal pelvis by retained non-purulent secretion, such retention being due to an obstruction to the outflow of urine. The obstruction may be localized in any portion of the urinary passages, but most frequently in the ureter.

Etiology.—Hydronephrosis may be congenital or acquired. The congenital variety is most frequently due to abnormal conditions of the ureter, viz., constrictions, twisting of the tube upon its axis, alterations in the lining mucous membrane resulting in a valve-like action, an entrance of the tube into the kidney at an abnormally high point, or the development of an acute angle, have all been noted as resulting in retention of urine in the pelvis of the kidney.

The acquired variety is due to obstruction of the ureter by calculi, cicatricial bands, abdominal or pelvic tumors, displacement of the uterus, pregnancy, etc.

Obstructive conditions within the bladder, such as cystitis with thickened bladder walls, tumors of various sorts, villous growths, also hypertrophy of the prostate gland and stricture of the urethra are not uncommon causes.

Morbid Anatomy.—Hydronephrosis may be unilateral or bilateral, the former being the common form. The distention may involve the entire pelvis, or a portion only. The latter variety is exceedingly rare. It may be constant or temporary.

The extent of dilatation of the pelvis and calyces, and wasting of the kidney substance, will depend upon the degree of obstruction. The resulting tumor varies in shape according to the location of the obstruction. If in the upper portion of the ureter it is of a globular or pyramidal form with the apex downward; if in the lower portion of the ureter, or lower urinary passages, the tumor is elongated. Inspection of the interior of the pelvis of the kidney reveals a number of accessory cavities corresponding to the dilated calyces. In highly developed cases the kidney structure disappears, the capsule of which, with the pelvis, constitutes the walls of a large sac distended with fluid. The degree of distention is at times very great, being equal in size to the head of a child. Externally, the sac is lobulated, the lobules representing the dilated calyces. If the distention is gradual in its development, the renal structure is stimulated to the development of interstitial tissue, which gives increased firmness to the organ and consequent greater power to resist the pressure. The largest tumors result from sudden obstruction. The capacity of the sac may equal forty to sixty ounces, and very much larger quantities have been reported.

The nature of the contained fluid is determined by the amount of secreting structure which remains. In most instances it resembles dilute

urine, being of a pale yellow color and containing but small percentages of the various solids, with the exception of sodium chloride, which is much increased. The specific gravity varies from about 1007 to 1015. There may be a little albumin. The presence of pus constitutes a pyonephrosis. In the cases which I have seen the microscope has shown plenty of pus corpuscles, even although the general appearance of the fluid did not present evidences of purulency. The supervention of a pyonephrosis upon a hydronephrosis is quite common.

Symptoms.—A slight degree of unilateral distention of the pelvis of the kidney may exist for some time without discovery. Small tumors are often overlooked, but whether large or small, the tumor is the most important feature of the disease. Its position is in one flank projecting below the costal cartilages, even to the pelvis. Its breadth is greater above, and it may reach even to or beyond the median line. The shape of the abdomen is not altered unless the cyst is of considerable size. The enlargement is usually localized, but has been observed to be general and resembling ascites. The surface of the tumor may be smooth or distinctly lobulated. The degree of tension is variable, some tumors being flaccid and fluctuation readily distinguished. Percussion is dull over the region of the tumor, except where encroached upon by the colon. Instances of cysts which occasionally empty themselves, attended by discharge of large quantities of urine, are reported. Such a condition may be due to a valvular development in the ureter, an abnormally high entrance of the ureter into the pelvis, or some form of pressure upon the ureter which is occasionally diminished. When hydronephrosis is bilateral, uræmia may result.

The patient sometimes complains of a tense feeling in the abdomen, vomits, the breathing may be oppressed, and the bowels constipated, all being the result mainly of the increasing pressure. Albuminuria is unusual. The amount of urine is not diminished unless both kidneys are involved.

Hæmaturia has been observed in cases which have resulted from injury. A general peritonitis may follow upon rupture of the sac. If suppuration takes place there may be febrile paroxysms and other evidences of pyonephrosis.

Diagnosis.—The tumors of moderate size are usually more readily diagnosticated than when first seen after they have attained large bulk, at which time they resemble ovarian tumors; but the lesser degree of mobility and the greater fixity, and extension of the renal tumor into the kidney region, are usually sufficient for differentiation purposes. In doubtful cases the aspirator should be employed. The fluid removed from the renal sac resembles a weak urine. The possibility of detecting urea, uric acid, and tissue elements belonging to the urinary tract, makes a diagnosis clear in most instances.

Pyonephrosis is distinguished by the coexistence of fever and of pus in the urine. The aspirator permits of a positive diagnosis. If constitutional symptoms are absent, pyonephrosis is diagnosticated from hydronephrosis with difficulty, indeed the latter may merge into the former. Hydatid growths in the liver or in the spleen develop upward and forward, hydronephrosis occupying the renal region first.

Prognosis.—Congenital cases are serious, and when bilateral, are likely to terminate fatally within a short time. When involving one side hydronephrosis may give little or no trouble for years, even when pressure has been sufficient to cause decided atrophy of the kidney. In these cases the other kidney has remained uninvolved and competent to perform the duties of both. After the cyst has attained large size it may produce serious pressure upon adjacent organs with the development of annoying symptoms. Death may occur from rupture. In rare cases the cavity may remain empty after a spontaneous discharge of its contents.

Treatment.—Relief sometimes occurs spontaneously, the gradually increasing pressure of the accumulating fluid forcing the calculus, or whatever the obstructing agent may be, onward into the bladder. If this result occurs soon, or is accomplished by surgical means, the renal structure may escape serious injury, although the pelvis of the kidney may remain dilated. It has been proposed to favor this result by means of manipulation, and although such measures have appeared to be successful in some instances, they are attended by considerable danger of rupture of the ureter. In cases not so relieved it is only possible to aspirate or cut down upon and drain the cyst. According to Morris, the favorable points for aspiration are, upon the right side, midway between the last rib and the iliac crest; upon the left side, at the anterior extremity of the eleventh intercostal space. Aspiration may be repeated, but it is wiser to incise and properly drain the cyst. During this operation the obstruction may be forced into the bladder or removed, resulting in complete restoration. Excision of the kidney may be performed if a purulent discharge continues, with constant failure of the patient. For medicines suitable to such cases consider the sections upon pyelitis and calculous disease.

DISPLACEMENT OF THE KIDNEY.

Synonyms.—Movable kidney; floating kidney; nephroptosis; ren mobilis.

In the normal state the kidney is firmly anchored in its position by a quantity of adipose tissue, which forms a capsule, by its bloodvessels, and by the layer of peritoneum passing in front of it.

Abnormal mobility of congenital origin has been observed as the result of a more or less complete envelopment of the organ by the peritoneum with the formation of a mesonephron. The acquired form is

as common as the congenital is rare. Important facts regarding it are (1) that it attacks women about six times as often as men, and (2) that the right kidney is displaced from twelve to fifteen times as frequently as the left.

The reasons advanced for the great predominance of this affection in women are (1) relaxation of the abdominal walls; (2) relaxation of the peritoneum; (3) changes in the capsule of the kidney as the result of repeated pregnancies; (4) compression of the lower portion of the chest by tight lacing.

A pendulous heavy abdomen, absorption of fat from about the kidney, increase in the size of that organ, severe bodily labor, especially heavy lifting, and injuries, particularly to the renal region, are all etiological factors, acting singly or in various combinations. Tumors may drag the kidney from its position, as in the case of a large fibro-rhabdomyoma of the kidney which I removed post-mortem some years since. It is also possible that the interposition of a large solid organ like the liver between the diaphragm and the kidney may have some influence in determining the greater frequency of displacement upon the right side.

According to Sir William Roberts, most cases develop between twenty-five and forty years of age, which is the child-bearing age of women. Movable kidney is not unknown in young children.

The displaced organ may become adherent in its new position, a most unusual result.

Bequet considers that the increased blood pressure which takes place in the kidneys during each menstrual epoch, increasing the size of the organ (which has been demonstrated in the displaced kidney), is a prominent factor in determining the greater frequency in females.

My own experience has furnished a much larger percentage in men than the ratio stated; indeed, considering only movable kidneys which have excited annoying symptoms leading to consultation with a physician, I have met nearly as many displaced kidneys in men as in women.

Symptoms.—A large number of displaced kidneys are not discovered during life, which has been shown by examination of series of old women, many of whom have been found to possess movable organs which had never been attended by symptoms. In this affection it is not uncommon to meet with groups of vague abdominal symptoms of long standing, which have possibly been especially annoying on account of inability to refer them to a demonstrable cause. I once had a patient who for years waxed eloquent over his abdominal distresses, which were finally shown to be due to a displaced kidney. Many complain of well-defined symptoms in the renal region, such as a sensation of "dragging," or of a sensation "as if something were loose," or of a localized pain, which at times becomes acute, radiating to the lumbar or sacral nerves, to the hypogastrium, testicle, thigh, and even the lower extremity. Sometimes

the pains are griping in character and may be attended by nausea and vomiting. The upright position and exercise usually aggravate the pain. Symptoms of a severe character may be developed with considerable periodicity, *e.g.*, during the menstrual period, and consist of chill, pain, vomiting and collapse. These attacks are not always due to the same cause, but probably result in most instances from obstruction of the ureter by torsion or the development of an acute angle. Hydronephrosis is the result. The urine is diminished during the attack and increased with the removal of the obstruction. The relation of nervous symptoms to the displaced kidney is not quite clear, nevertheless they are frequently associated, and are those of a hysterical character in women and of a neurasthenic form in men, although women often develop symptoms of the same character. In what degree they are dependent upon the displacement it is difficult to determine, although successful operations for replacement and anchorage of the organ in its normal position are often followed by great relief. In some cases which I have observed they have developed only after the patient became acquainted with the nature of the affection, which suggests the withholding of a diagnosis in the case of nervous individuals.

Symptom groups resulting from pressure of the kidney upon neighboring parts constitute a rare feature of the symptomatology. Cases have been recorded in which œdema of the lower extremities resulted from pressure upon the inferior vena cava. Pressure upon the duodenum, according to Bartels, is a not uncommon cause of dilatation of the stomach, although some observers will not admit the claim. Pressure upon the gall ducts may excite jaundice, and constipation may be a consequence of compression of the colon.

Diagnosis.—Palpation reveals the existence of a tumor, which presents a firm, smooth surface, and resembles the kidney in size and shape. It is usually detected in the side of the abdomen between the edge of the ribs and the crest of the ilium, is freely movable, and may usually be pressed upwards and backwards into the hypochondrium. When the pressure is relaxed, particularly if a deep breath is taken, the organ is again returned to its abnormal position. Squeezing the kidney develops a peculiar sickening sensation. It is often possible to effect a displacement downward from the position in which it is found, or to or beyond the median line. In some instances the pulsations of the renal artery may be detected.

Bimanual palpation is the method of examination employed. It is carried out by placing the patient upon the back with the shoulders elevated and the thighs flexed upon the abdomen. The patient being instructed to breathe with the mouth open and to relax the abdominal walls, the examiner places one hand posteriorly between the last rib and the crest of the ilium, employing the other hand upon the abdomen.

By this method detection of the displaced kidney is easy if the abdominal walls relax and do not contain much fat. It is seldom necessary to employ an anæsthetic. Displaced kidneys which are not discovered are, in general, those which are not suspected to exist, and consequently not searched for. An examination of this character should constitute one of the features of every thorough general examination of a patient.

Conditions resembling displaced kidneys are numerous. Distention of the gall bladder, which organ may be sufficiently mobile to resemble the kidney, may confuse, but its cystic character can generally be determined; also ovarian tumors: these are limited in their upward movement, do not have the kidney shape nor develop the peculiar sickening sensation when compressed. An enlarged spleen is found immediately beneath the abdominal walls, is not covered by the colon, and its outline can be more readily percussed. Tumors of the mesentery, pancreas, and alimentary tract, are more painful, do not possess the kidney shape nor peculiar tenderness, and are more apt to have an uneven surface.

Prognosis.—The importance of displacement of the kidney is variously estimated, some considering it as a condition attended by much danger, while others deny that it is more than a source of annoyance to the possessor. Undoubtedly, each case must be estimated by the symptoms. It may be quite positively stated, however, that an uncomplicated movable kidney is not dangerous to life, although in most cases the symptoms are exceedingly obstinate and are often not materially relieved by treatment.

Treatment.—For the acute symptoms it is necessary to put the patient at rest, replace the kidney if possible, followed by the application of some retaining apparatus. Violent pains not relieved by this method call for hot fomentations, hot baths, and occasionally for the use of morphia. A period of rest in recumbency extending over some weeks may be required. A variety of mechanical means have been employed, none of which are highly satisfactory. A simple broad bandage, with a large pad attached at the proper point, may be applied with the patient in recumbency and after the kidney has been replaced. The size, shape and consistency of the pad may require repeated change before a satisfactory result is attained. Newman uses a rubber pad which can be inflated after adjustment. A spring truss, furnished with a large pad, and a corset compressing the lower portion of the abdomen, are both worth consideration. In troublesome cases the kidney may be stitched in its normal position, or if the organ is much diseased and its mate able to accomplish the work of the kidneys acceptably, it may be removed. The operation of nephrorrhaphy has received considerable attention and is meeting with increasing success.

The displaced kidney should not absorb all of the attention of the attendant, who should investigate the general health in all its particulars.

NEPHROLITHIASIS.

Precipitation of certain of the urinary solids leads to the formation of concretions varying in size from a mere point up to the capacity of the renal pelvis. Most are about the size of a small pea. When a quantity of individual crystals are passed, this fine deposit is commonly spoken of as "renal sand;" a coarser variety, as "gravel." Calculi cause attacks of severe pain during their passage from the pelvis of the kidney to the bladder; the finer forms not necessarily exciting acute pain, but there may be some degree of soreness and discomfort upon the affected side. Renal concretions may be found in the pelvis, and in the calyces of the kidneys, within the structure of the gland, in the bladder or prostate; they may also be arrested in the ureter or urethra.

Concretions of *uric acid* are most frequently met. They are of a roundish or oval shape, may have facets caused by pressure, are smooth or finely granular, quite firm, and vary in color, being of yellow, brown, or black tints. The breakage is crystalline, and the cut section of a large stone may appear laminated. The size is most variable. They may be present in large numbers.

Oxalate of lime calculi are less common. This substance is usually combined with uric acid, which may form the nucleus, or they may be arranged in alternate layers. Their color is dark brown, and they are extremely hard and rough, being covered with points, which has led to the appellation of "mulberry calculus." Breakage reveals a radiate arrangement in some instances. Some of the smaller stones are smooth. They are seldom multiple.

Calculi of a phosphatic character are seldom composed of phosphate of lime or ammonio-magnesium phosphate only, but these substances are combined with carbonate of lime, and still more frequently form a deposit upon uric acid or oxalate of lime calculi. Calculi of triple phosphate only are but rarely met. They are light in color, of small size, rough, and their consistency such that their shape may be changed by pressure. They fracture with a crystalline surface. This form of calculus is devoloped in urine which has undergone ammoniacal degeneration. Deposits may also occur upon any foreign matter within the bladder, and even upon the inflamed mucous membrane of the bladder or pelvis of the kidney. They are light in color, soft, brittle, and may attain great size, particularly in the bladder. Under intense heat they are transformed into a porcelain-like mass.

Less common forms of calculi are composed of cystin, xanthin, indigo, phosphate or carbonate of lime, urostealith, and urate of soda.

Cystin calculi have a yellowish color, become green upon exposure, glisten with crystals, and have slight consistency. Sections have a translucent appearance, and manifest some degree of radiation in their structure.

Xanthin. This form is exceedingly rare, of a cinnamon color, and in general physical characteristics resembles those composed of uric acid. They have not been observed in the pelvis of the kidney. Xanthin calculi are soluble in certain strong alkalies, especially strong ammonia.

Indigo. The existence of calculi composed of indigo seems to be based upon the single case observed by Ord, who discovered one of large size in a sarcomatous kidney. This calculus was bluish-black, and made a blue mark upon paper. It contained coagula of blood and some phosphate of lime.

Phosphate of lime produces whitish, chalky calculi, of variable size.

Carbonate of lime. Unlike the phosphatic form, the carbonate gives a smooth, hard, yellowish, grayish or brownish calculus, which is not inclined to attain great size. Its principal seat of development is the prostate gland.

Urostealith is a rare form of calculus consisting of cholesterin, fat, uric acid, etc. It is soft and has a greasy feel.

Urate of soda calculi are soft formations and inclined to be small.

The above represent the most typical forms of renal calculus, but it must be remembered that there are various combinations of these substances constituting rare varieties.

The nuclei of calculi were long supposed to consist of uric acid, and while this is frequently the case, they may be also composed of oxalate of lime, urate of soda, or the crystals may adhere to particles of mucus, to renal casts, coagula of blood, and the ova of bilharzia hæmatobia. There can be no doubt as to the origin of renal calculi within the urinary tubules, even within the epithelial lining of the tubules. The relative insolubility of certain substances contained in the urine, especially uric acid, oxalate of lime, etc., accounts in the main for the greater frequency of these forms of calculi.

Ralfe sums up the present state of our knowledge of the origin of calculi as follows:

"(1) That all urinary calculi, except those formed upon extraneous substances introduced into the bladder, have a renal origin.

"(2) That the nuclei of all renal calculi, except those of evidently hæmic origin, are developed in the tubules of the kidney.

"(3) That these nuclei probably take their origin in the renal cells, by the retention within them of uric acid, oxalate of lime, or phosphate of lime, owing to some vital impairment of their function, by which their power of eliminating these substances is diminished.

"(4) That the nucleus, having passed into the urinary passages, grows by gradual accretion in successive layers to its surface, the material for which is furnished by the mucus of these passages, and the substances deposited from the urine.

"(5) That the nature of the successive layers of a fully formed calculus will be found to vary according to the prevailing character of the urine, at the time of their formation, so that in the same calculus we may find layers of uric acid alternating with phosphate of lime, and finally incrusted with a coat of triple phosphates, or any other possible variation."

As the result of a communication between the biliary and renal systems, biliary calculi have been found in the renal passages.

The influence of renal calculi upon the tissues with which they are in contact is usually that of an irritant, exciting catarrhal or purulent inflammation. Ulcerations may form, resulting in perforation of the intestines, stomach, peritoneal cavity, pleura, lungs or external tissues of the loin, with discharge of calculi in any of these directions.

Calculous pyelitis often involves the kidney structure by extension, giving rise to multiple abscesses or interstitial development. This process may extend to complete destruction of the kidney, and conversion of this organ and its pelvis into a large sac containing purulent fluid and calculi.

There is a strong tendency to disease of the other kidney, which may undergo lardaceous degeneration. When one kidney only is involved, the second undergoes some degree of compensatory hypertrophy.

It is not a rare observation to find calculi numerous and rough, even very large concretions, filling the entire pelvis and calyces and exciting pressure upon the kidney, without the development of a purulent catarrh. Such conditions have in some instances apparently existed for years.

Aside from inflammatory conditions and their consequences ensuing upon the development of calculi in the pelvis of the kidney, obstruction of the ureter is a not uncommon consequence. Such obstruction is often only partial, the calculus being of such a shape or located in such a manner as to permit the urine to pass with greater or less freedom. Under these circumstances, while permitting the escape of urine, the calculus may excite ulceration and perforation. In other cases the occlusion is complete with the development of a tumor, this condition being designated as hydro- or pyonephrosis, according to the nature of the contents of the sac.

The pathological complications of calculous disease represent considerable variety. Aside from conditions enumerated, there may be catarrh, ulceration or perforation of the ureter, catarrh of the bladder, vesical calculus, hypertrophy of the prostate, and various affections of the urethra. Some form of Bright's disease may also coexist.

Age, sex, climate, habits, heredity, traumatism, and predisposition, are influential in calculous disease.

The influence of age is illustrated by the statistics of Sir Henry Thompson, which show that in 1,827 operations for stone, 1,158 of the subjects were under 25 years of age, 1,001 less than 15 years of age. The number of cases between 25 and 35 years of age was only 231, and those between 35 and 55 years of age, 303. This frequency of stone in young persons is attributed to impaired vitality, especially of the renal epithelium, frequent illnesses, overgrowth, etc. The prolonged periods of acid urine to which children are subject also favors precipitation of uric acid and urates. Retention of calculous matter in the urinary tract is also favored by the relatively small size of their urinary tubes.

In respect to the predominant forms of calculi in the various periods of life it may be stated that the uric acid variety preserves the lead in all decades, but that during middle life those composed of oxalate of lime are especially common. In advanced life the tendency to a formation of pure phosphate of lime is greater than at earlier periods, with a corresponding tendency of the urine to undergo ammoniacal decomposition.

Sex. Being less exposed to predisposing causes, females are less subject to calculous disease; also, the shortness and greater dilatability of the urethra in women favors the expulsion of calculi.

Climate. The tendency to calculous formation seems to be decidedly influenced by climate. Great differences in the relative number of cases of calculous disease exist in different countries, and in various regions of the same country, which is attributed to the character of the drinking water, of the soil, and to meteorological states. The influence of drinking water is undoubted, the use of certain kinds being followed by the development of calculi in some individuals. In these cases a predisposition must exist. I have repeatedly noticed that patients suffering from some form of crystalline deposit in the urine, or without any such deposit, would, upon making a radical change in the drinking water, *e. g.*, visiting another portion of the country, or some spring, be attacked with renal colic.

The influence of the soil is manifested in the character of the water it produces, and in some degree by the amount of subsoil dampness.

Atmospheric conditions are influential chiefly by reason of their ability to produce catarrhal states. In dry, cold countries calculous disease is rare.

General habits of diet exert a very decided influence over the calculous process. High living, *i. e.*, excessive indulgence in animal food and alcoholic beverages, especially if associated with sedentary habits, exerts a divided influence. Any character of diet leading to dyspepsia, acid fermentation, and disturbance of nutrition, is favorable to the development of renal calculi. In many instances the most objectionable food consists of saccharine, starchy and fatty matters.

Symptoms.—Attention is usually called to the existence of calculi

by an attack of renal colic, which is the paroxysm of pain excited by the passage of a calculus through the ureter. The presence of such a calculus in the pelvis of the kidney may give rise to a certain amount of pain, tenderness, and perhaps a sense of dragging in the affected side. The pain is apt to be increased by jars such as occur in riding over a rough road, but acute pain is seldom developed unless the calculus is of such a size as to engage the ureter. Attacks of renal colic may follow on some sudden effort, but more often without an apparent exciting cause. The pain is agonizing and first felt in the flank, extending gradually forward and downward along the ureter of the affected side into the testicle, which is retracted, and along the inner side of the thigh. In some cases the pain extends to the heel or sole of the foot; in others it may involve the abdomen and chest, or there may be a focus of great intensity in the back. There are periods of remission in the pain. Urination is usually frequent, urgent, and a little blood may be mixed with the urine. A large amount of clear colored urine is sometimes observed, which comes from the sound kidney. Sir William Roberts has applied the term "obstructive suppression" to cases in which suppression of the urine takes place, even when the tube upon the opposite side is not obstructed. It is not unusual, under these circumstances, for death from uræmia to take place. It is usually found that there is disease of the kidneys, or, as in several reported cases, an absence of one of these organs. The same condition may result from compression of both ureters by morbid growths. The attack of colic may be initiated by a chill, which may be succeeded by a marked elevation of temperature. The circulatory failure, which sometimes develops, may be sufficiently sudden in its onset to simulate a more serious affection. Nausea and vomiting are constant features of severe attacks. The intense pain, with a little occasional relief, continues until the calculus drops into the bladder. In case of failure of the stone to pass the ureter, the pain diminishes after a certain number of hours to be renewed again, perhaps repeatedly, until the passage of the calculus. It may be impossible for the calculus to pass the ureter, in which case some degree of pain continues, associated with symptoms which are described later. It is possible in some thin persons to palpate a large calculus in the ureter and follow its downward movement.

The presence of calculi sometimes gives rise to less severe symptoms, especially of a reflex character. These consist of various pains and sensations in the limb and foot of the affected side, irritability of the bladder, and pain in the spermatic cord and testicle and retraction of the testicle. Pains resembling locomotor ataxia have also been observed.

Quite typical symptoms of renal calculus are sometimes produced by the irritant influence of numerous crystals or fine gravel in the urine, particles which do not at all obstruct the ureter; even frequent urination, blood corpuscles in the urine, and retraction of the testicles may attend.

Calculi and gravel may be the cause of lumbar pains of a persistent character, and in some instances they are subject to occasional exacerbation. This condition is usually diagnosticated as lumbago. The pain is in general of a dull aching character and aggravated by rough riding jumping, or violent exertion of some sort. In these cases there is ultimately an attack of renal colic when the urine is found to contain mucus, blood, and pus in small quantity, perhaps requiring the microscope for their detection. Instances have been recorded of the disappearance of symptoms attendant upon stone, due to encysting of the calculus.

The continued presence of a calculus in the pelvis usually excites catarrh, which soon becomes purulent in character. If obstruction of the ureter takes place, the secretion accumulates, giving rise to a tumor. The obstruction may be continuous or intermitting, in case of the latter, the amount of pus in the urine will be subject to sudden fluctuations.

Blood is present in the urine after each attack of colic. The amount is sometimes considerable. It may give the urine a smoky hue when the discharge is slight and acted upon by an acid urine. It may form coagula in the pelvis and excite colic during its passage through the ureter. Hæmaturia may exist as a rather persistent symptom of stone in the kidney. In these cases the bleeding is apt to be developed by exercise of certain kinds, especially riding in a carriage, which is in marked contrast to the conditions of aggravation existing when the calculus is in the bladder. The latter patient is able to ride without aggravation, but his symptoms are increased by walking. The source of the blood is more likely to be the kidney if the urine is of acid reaction. When from the bladder the urine is alkaline and contains a muco-purulent sediment. Calculous patients may pass in the course of years an enormous number of stones, others may for years have gravel in their urine, but never have suffered from an attack of renal colic; others may develop one or more calculi within the kidney substance, sometimes of a large size, without a history of attacks of renal colic or of gravel. The existence of a stone in the kidney may give rise to the discharge of purulent urine through a period of many years without the occurrence of renal colic at any time.

Pyelitis as a consequence of calculous irritation is characterized, in some instances, by marked fever paroxysms, repeated in such a manner as to suggest malarial infection. The urine will probably contain blood, and epithelium from the deeper layers of the mucous membrane, is turbid, and usually contains crystalline matter. The various forms of pyelitis and the relationship of the disease to calculi are fully considered in another article.

Diagnosis.—Renal colic sometimes resembles biliary colic, but the latter is followed by jaundice. It may also be difficult for a time to distinguish renal from intestinal colic, but by keeping in mind the promi-

nent features of renal colic, viz., the situation and direction of development of the pain, the urinary symptoms and changes in the urine, and the retraction of the testicle, it will be impossible to remain long in doubt. Attacks of acute pain somewhat resembling renal colic have been observed in connection with movable kidney, but the absence of urinary changes and the discovery of the displaced kidney make the diagnosis clear. Attacks of renal colic due to the expulsion of coagula of blood, bits of morbid growths, etc., cannot always be at once distinguished from calculous cases, but examination of the urine reveals the cause. A mild degree of the typical symptoms may attend the separation from a highly acid urine of fine crystals of uric acid. The crystals are found in the urine, and if this fluid is rendered alkaline, both the crystals and the pain disappear.

Hysteria may simulate renal colic sufficiently to lead to confusion for a time.

Palpation has revealed crackling sensations when the pelvis contained many calculi. Puncture with a long needle has been employed for diagnostic purposes, after exploratory incision.

To determine whether a stone occupies the pelvis of the kidney or the bladder is sometimes difficult even with the aid of the sound. If the urine is alkaline, contains muco-purulent sediment, and there is vesical irritability, the stone is probably in the bladder. A large calculus occupying the pelvis of the kidney presents symptoms not unlike cancer, and the question is further complicated by the possibility of carcinoma developing secondarily to calculous disease. In cancer the amount of blood lost is greater and not especially excited by exertion, as in the case of calculus. Cells from the cancer growth may be found in the urine, also little jelly-like masses after hæmaturia. The urinary sediment in cancer contains less mucus, pus, and fewer crystals. Perinephritic abscess is characterized by diffuse infiltration of the kidney region.

It is for obvious reasons important to determine the chemical character of the calculus. The result is often uncertain, even after a careful review of the history of the case, and an examination into its urinary features. It may be stated in short respecting the most common forms, that with an acid urine containing considerable mucus, with a yellowish or slightly reddish sediment, the frequent presence of blood in small quantities after exertion, and a somewhat periodical tendency to hæmorrhage, not attributable to exertion, that if, with these conditions, there is a history of a long-continued lithæmia, which may even of late have quite ceased, it is probable that the stone is composed essentially of uric acid.

An oxalate of lime calculus may be suspected if a melancholy dyspeptic, who has been a subject of oxaluria, has with other suspicious

symptoms, frequent dark-colored hæmorrhages, and a urinary sediment of a greenish muco-purulent appearance.

Persistent ammoniacal urine, little bleeding, much pain, large deposit of muco-purulent matter and flocculent mucus, suggest a phosphatic calculus.

Prognosis.—It is difficult to formulate statements respecting the future of calculus cases, especially as the influence of calculi upon the tissues varies so much in different individuals. In one a small concretion excites severe purulent inflammation, while in another a large calculus may be present for years without producing symptoms of a very troublesome character. The great majority recover promptly from renal colic, although it may prove fatal from shock, especially in the old and feeble. Renal colic is usually repeated, although one or two paroxysms may be followed by entire freedom in the future. It is favorable if crystalline elements and evidences of catarrh or of suppuration disappear from the urine. After the development of pyelitis, cystitis, and especially of destructive changes in the kidneys, the outlook is gloomy, although surgical interference is sometimes successful. Most calculi which pass into the bladder are soon discharged or removed by appropriate treatment. Failure to void the stone results in a gradual increase in its size and the establishment of a calculus in the bladder. If retained in the pelvis or kidney it may excite catarrh and all the changes detailed in the articles upon pyelitis, pyonephrosis and suppurative interstitial nephritis.

Treatment.—The treatment of renal colic should be prompt and effectual. Before narcotics are used, which is often necessary, the bowels should be thoroughly unloaded by means of large stimulating enemata, which appears to favor the progress of the calculus toward the bladder, and removes possible obstruction due to constipation. Hot fomentations to the painful side, hot foot-baths, or better, a general hot bath, accomplish much in the relief of the pain. The free use of hot drinks is also advisable. If these measures in association with the administration of *belladona, nux vomica, pareira brava* or *berberis,* as indicated by the symptoms, do not relieve the pain sufficiently, it is necessary to resort to inhalations of *chloroform* or hypodermatic injections of *morphine.* In the use of the latter agent care must be observed in the repetition of the dose, as the sudden cessation of pain may greatly diminish the patient's tolerance of the drug.

After the attack the patient should be instructed to make daily attempts to expel the stone by permitting the bladder to become well filled, then to urinate in strong jets by compressing the meatus while lying upon an inclined plane with the head lower than the pelvis. Persistence in this plan often leads to success. It is hardly necessary to add that all urine passed should be carefully inspected until the calculus is

discovered. Failure may result if the prostate gland is hypertrophied or the urethra strictured.

In the intervals between attacks the patient's general condition should be carefully investigated and measures adopted for the prevention of calculous formations. Dietetics and the mode of living are most important. In most, especially acid cases, the diet should be spare. The amount of meat ingested should be lessened, and in some it may with advantage be temporarily abandoned as an article of diet. The same may be said of all alcoholics, although least objectionable when the calculi are phosphatic. Water, especially distilled water, should be freely taken, also an abundance of exercise in the open air. The latter is so important that when possible a winter residence permitting an outdoor life should be selected.

Certain mineral springs are beneficial, but their influence is much over-rated, the good results being due more to change of habits of life, of scene, air, diet, and the free use of water, than to any particular chemical composition of the water taken. It is, nevertheless, often good practice to recommend a course at Vichy, Ems, Carlsbad or Marienbad, in Europe; or at Saratoga, Bedford, Capon or other springs in this country. The composition of these waters and their adaptability to special cases must be learned from special treatises.

The administration of various substances for the solution of stone in the renal passages is a practice much employed in former times, but which has been almost abandoned since the introduction of modern methods of operation, and especially since the use of the lithotrite. Some success has been of late reported by Sir William Roberts, Ralfe, and others. Vesical calculi of the uric acid type are most susceptible to this treatment as they are more thoroughly subjected to the influence of the medicated urine.

Roberts's method for the solution of uric acid stones consists in giving for weeks or months one-half to one drachm of citrate of potash every three hours, in six or eight ounces of water. There is a liability of the urine becoming ammoniacal, which is an indication that the treatment should cease. Oxalate of lime or phosphatic concretions are not influenced by this method.

Stone in the kidney may be attacked surgically if the patient is incapacitated from work or suffers great pain, also if the pelvis of the kidney is distended with urine or pus, but unless there is serious interference with comfort and the getting of a livelihood one should hesitate to take the risk, as a stone may exist in the renal structure for many years without involving the health seriously.

The remedies which may be employed to arrest the formation of calculi are numerous, embracing not only the few which have some known relation to the various forms of crystalline deposit in the urine,

but remedies acting favorably upon dyspepsias, gastric catarrh, hepatic affections and nutritive disorders generally. Those which require a special study are *lycopodium*, *nux vomica*, *pulsatilla*, *sarsaparilla*, *sepia* and *sulphur*; also *berberis*, *benzoic acid* and the various *benzoates*, *calcarea carbonica*, *chelidonium*, *phosphorus* and *phosphoric acid*.

Hughes advocates *quinine* when the symptoms are neuralgic. *Nitro-muriatic acid* and *nitric acid* are decidedly effective against oxaluria, but must often be given in good-sized doses. *Nitric acid* in sufficient doses, after meals, will frequently clear the urine of uric acid. The influence of *piperazin* is less certain. *Phosphoric acid* and *phosphorus*, also *magnesia phosphorica*, are valuable in phosphaturia.

CYSTIC DEGENERATION OF THE KIDNEYS.

Cystic disease of the kidneys may be divided into several varieties: (1) That form of cystic degeneration associated with chronic interstitial nephritis; (2) "Cystic disease;" (3) The solitary cyst; (4) Hydatid cysts; (5) Dermoid cysts.

Passing by the cystic development associated with chronic interstitial nephritis, which has been sufficiently described in the section treating of that disease, the extensive cystic degeneration of the kidneys which occurs as a pre- and post-natal development and designated "cystic disease," or cystic degeneration, will be considered.

In the congenital form the kidneys are greatly enlarged, sometimes weighing many pounds, and forming large tumors occupying the lumbar region. Both kidneys are usually involved. Upon inspection they are found to be studded with projecting protuberances representing cysts. Section reveals the fact that most of the renal structure has disappeared, the organ being composed of a multitude of cysts of various sizes containing a dark albuminous liquid which seldom contains urea, uric acid, or other of the urinary solids, but blood crystals, triple phosphates, cholesterin, etc. This condition was thought by Virchow to be due to tubular inflammation resulting from uric acid and blood infarcts, these substances being often precipitated in the straight tubes during fœtal life. It is thought that this cause of obstruction may be supplemented by connective tissue development. Cases have been observed in which the obstruction was due to plugging of the ureter. Congenital cystic degeneration is frequently associated with congenital malformations of various sorts, such as transposition of the viscera, clubbed foot, etc., suggesting a developmental rather than a pathological origin. Shattock and Sutton suggest that it is the result of defective development, the Wolffian bodies, these being imperfectly differentiated, unite with the kidneys and become the source of the cysts. Few subjects of this affection survive birth very long. Many die during fœtal life, others may live until adult life.

Symptoms.—These are obscure, but of essentially the same character as those attending chronic interstitial nephritis. There may be some pain in the lumbar region, but seldom any dropsy. High arterial tension and enlargement of the heart are unusual. Hæmaturia is occasionally present. Death may result from cerebral hæmorrhage, uræmia, suppression of urine, or any of the well-known terminations of Bright's disease, especially those connected with the lungs.

Diagnosis.—The nature of the disease is often in great doubt, and depends upon the discovery, in connection with symptoms suggesting chronic interstitial nephritis, of enlargement of one or both kidneys. While the disease is bilateral the lesion is often much further advanced in one organ, which suggests a difference in the size of the kidneys.

Solitary or simple cysts probably arise from obstruction. They vary in size from that of a pea to that of a fist. One or both kidneys may be involved. They develop from the cortex, forming globular protuberances upon the surface of the kidney. The contents vary in character, but are usually clear, albuminous, and free from urea or uric acid. Even when of large size these cysts are apt to be overlooked during life, as the kidney structure not immediately involved is usually in a normal condition.

Treatment.—The treatment must be conducted as for Bright's disease. Surgical measures promise little, for the reason that both kidneys are usually involved.

If the cyst is large enough to form a tumor it resembles a hydronephrosis, but differentiation is not of the highest importance, as both require the same treatment, viz., surgical.

The remaining forms are exceedingly rare. Hydatid cysts of the kidney are considered in the section devoted to parasitic affections.

NEW GROWTHS OF THE KIDNEYS.

New growths involving the kidney may be primary or secondary, benign or malignant.

Clinically some enlargements of the kidney which cannot be considered as neoplasms are rated as tumors. The primary growths are most important, particularly the malignant formations, although they are very rare, constituting only about one-half of 1 per cent. of the total number of malignant growths involving all regions of the body. In practice it is impossible to separate carcinoma and sarcoma with any certainty.

CARCINOMA.

Primary carcinoma is usually observed in middle or advanced life. It is more frequent in males than in females. In the majority of cases it cannot be related to even a supposed cause. Some appear to be excited

by traumatism, but more frequently it is developed upon calculous disease. Just how renal calculi stimulate such a development is unknown, but it is probable that in most cases they exist in the pelvis of the kidney, or in the renal substance for lengthened periods of time, acting as constant irritants. It is usually unilateral in development. The kidney is considerably enlarged, often greatly so, but does not attain the large bulk of renal sarcoma. The consistence of the growth depends upon the variety, the medullary and colloid forms being soft, the scirrhus hard. Many gradations are observed. The majority are of the medullary type. Scirrhus is rare. The growth may be diffuse or nodular, and usually originates in the epithelium of the cortex. The capsule of the gland is usually thickened, the kidney preserving its bean shape unless nodular growths distort its surface. The unaffected renal structure may undergo some inflammatory or degenerative change. Adhesions may develop between the kidney and adjacent tissues, and in some instances the peri-renal structures are infiltrated by the new growth. Degenerative changes may take place, leading to softening and evacuation of the detritus by way of the urinary tract. The degenerative products may be retained and appear first at the autopsy. The parenchyma of the gland may be almost completely destroyed, the capsule and pelvis constituting the firm outer wall. Hæmorrhage is common. The size of the tumor is sometimes such as to seriously compress or displace neighboring organs. The pressure of the new growth may produce erosion of the vertebræ, with compression of the spinal cord and resulting paralysis of the parts below.

Symptoms.—The most important symptom is the presence of a tumor in the renal region, which may be smooth or nodulated. It permits of some movement, or is bound by adhesions. Its position will depend upon the size and also upon the mobility of the kidney. The organ may be dragged from its normal position and occupy the iliac region and be mistaken for a tumor of the ovary, or be arrested at some intermediate point, resembling a tumor of some other organ. The size of the tumor may be sufficient to occupy one-half of the abdomen. Irregular protrusions may be felt upon its surface. Soft tumors may fluctuate. The abdominal veins may be distended. Pulsations have been observed in the tumor and bruits have been heard.

Hæmaturia occurs in fully one-half of the cases. The amount of blood lost is not usually great and the flow is intermittent. The blood may be intimately mixed with the urine, or appear in clots, which sometimes take the form of the ureter. The quantity of albumin corresponds to the amount of blood, a disproportion between the two suggesting the coexistence of Bright's disease. Examinations of the urine with the microscope give negative results in so far as the detection of cancer elements is concerned. In respect to color, reaction, specific gravity and

the quantities of the important solids, the urine may be normal. The amount of pain is variable. It may be severe even in association with small tumors, while large ones may be entirely unattended by discomfort of any kind. It is seldom of an acute character, is not affected by movement and involves the lumbar region particularly. Attacks of renal colic may be excited by the passage of coagula of blood or portions of the morbid growth through the ureter.

As in malignant growths generally there are progressive loss of flesh and strength and some degree of anæmia. The appetite is poor or absent. There may be nausea, vomiting, and the bowels may be either constipated or relaxed. The fatal result is in the main from exhaustion, although extension of the growth to the stomach, peritoneum or other neighboring structures, may constitute a factor. Secondary foci may be developed in many of the organs.

Diagnosis.—The existence of a tumor in the renal region associated with hæmaturia, pain and tenderness, should awaken a strong suspicion of malignant disease of the kidney. It must be differentiated from the various diseases of the kidney giving rise to a tumor, particularly distention of the pelvis of the kidney with urine or pus, tuberculosis, hydatids and cystic degeneration. As advanced tuberculosis of the kidney is usually attended by pyonephrosis, it may be included with the affections just named, which upon clinical examination give the impression of an elastic sac containing fluid. A rapidly growing carcinoma may, in rare instances, be soft enough to give rise to the same sensation. Again, in tubercular disease of the kidney the tubercle bacillus may be discovered in the urine. The urinary condition associated with cystic kidneys is sufficient for differentiation, the urine being large in quantity, pale, containing a trace of albumin and a few tube casts.

Tumors and affections of neighboring organs may resemble cancer of the kidney. Ovarian tumors develop from below, while renal growths grow downward from the renal region. As the colon is in front of the tumor there will be upon the right side a tympanitic band between the upper margin of dulness and the ribs, which is not the case in enlargement of the liver. The same tympanitic band will exist upon the left side if the tumor is associated with the kidney rather than the spleen. The spleen is also detected by its notched edge and its descent during inspiration. Fæcal masses in the intestine are removable by a purge or by large enemata. Abscess about the kidney excites febrile symptoms and the peri-renal structures are infiltrated and attended by marked tenderness and pain. Enlargements connected with the mesenteric glands or omentum occupy the central portion of the abdomen and are distinctly nodular. If the patient is a child and the growth very large it suggests sarcoma. In all cases of large size the importance of looking for the colon where it crosses the growth must not be forgotten.

Treatment.—Palliation is the only available treatment, as a diagnosis cannot be made with certainty at a sufficiently early date to permit of operation with any prospect of success. The general treatment and medicines called for are the same as employed for carcinoma in other parts.

SARCOMA.

Sarcoma of the kidney is usually a primary growth and most frequently met in the very young, even in infants. It is characterized by a large tumor, which may fill a considerable portion of the abdomen in some cases. It possesses the general characteristics of a renal growth, viz., it occupies the region of the kidney, distends the loin, grows downward and is covered by the colon. The contour of the growth is smooth; it may be firm on pressure or so soft as to suggest the existence of a cyst. The progress of the growth is rapid and attended by a corresponding degree of emaciation and prostration ultimately proving fatal.

BENIGN GROWTHS OF THE KIDNEYS.

These occur in considerable variety. The most frequent form being the small nodular *fibromata*, which may develop in kidneys otherwise healthy or be associated with chronic interstitial nephritis. They vary in size from a minute point to the size of a pea and possess no clinical importance. Fibrous tumors of large size are exceedingly rare, and the same may be stated of the small lipomatous accumulations which take place beneath the capsule. *Angiomata* of cavernous type are also a rare form of kidney tumor, attaining the size of an English walnut in some instances. *Villous* growths are rare and usually involve the pelvis of the organ. *Osseous* formations have been found in the fibrous tissues developed in the course of chronic renal disease. *Cartilaginous* growths may also take place. *Gliomata* of small size may be found in the cortical portion of the kidney. *Myxomatous* nodules may exist alone or in combination with sarcomata, the larger ones giving rise to a tumor and attending symptoms. The smaller ones are without significance.

AFFECTIONS OF THE BLADDER.

CYSTITIS.

Classifications.—Attempts have been made to divide inflammation of the bladder into varieties, basing the classification on the portions of the bladder involved, the mode of infection giving rise to the trouble, or the relative acuteness or chronicity of the symptoms. However inter-

esting such classifications may be from a theoretical standpoint, they are as yet without practical clinical bearing.

Etiology.—The essential cause of cystitis is local microbic infection. Other factors, as cold, traumatism, etc., may enter into the case, but they are without influence, excepting in so far as they prepare a suitable soil, rendering infection possible. The normal vesical mucous membrane, as do the other normal tissues throughout the body, offers considerable resistance to infection. It is for this reason that some exciting cause is usually apparent in each and every case of cystitis. That cause may be an apparently trivial one, but it is sufficient to excite local congestion, which condition develops the suitable nidus for the growth of the invading micro-organisms. This congestion may be brought about by inordinate distention of the bladder. The vascularity of this organ is always increased when distended; but when to an unusual extent, the detrusor muscle contracts and the congestion is still further intensified, which continues to increase until the condition is relieved. Congestion of the bladder is also favored by increased muscular effort, such as is necessitated by narrowing of the urethral calibre, as in stricture and enlarged prostate. Mechanical causes are active in some cases, *e. g.*, the irritation of a calculus or bungling instrumentation.

Retention of urine is another cause which favors local infection of the bladder; this it does, as already suggested, by favoring congestion and necessitating increased muscular effort in the evacuation of the bladder, the retained urine under these circumstances becomes a favorable medium for the growth of microbes.

Cases of cystitis have undeniably been traced to cold. In such instances, the sudden chilling of the surface has produced severe visceral congestion; infection does the rest.

We have thus seen that the two essential factors for the production of cystitis are local predisposition and local infection. The latter takes place in the majority of instances as the result of gonorrhœa, and usually not until the latter disease has lasted three or four weeks. While the inflammation may travel backwards and finally invade the bladder without help, as a rule the bladder does not become infected unless the gonorrhœa is treated injudiciously by injections or the introduction of instruments. It is not an uncommon thing for specific inflammation to invade the deep urethra, and under such circumstances, a simple cause like indulgence in alcohol, sexual intercourse, etc., may readily light up a bladder inflammation. The same causes, injudicious medication and instrumentation, and excesses, may bring on a cystitis during the course of a gleet, but in such cases there is usually a strictured urethra present which, of itself, is sometimes an all-sufficient cause. In patients of advancing years, the most frequent cause of cystitis is probably prostatic hypertrophy, this condition producing retention of urine, vesical conges-

tion and changes in the bladder walls. The retention of urine and the cystitis, as a rule, do not appear until the patient is exposed to cold or has committed some indiscretion in diet or sexual hygiene.

Local causes starting within the bladder are responsible for some cases. These include calculus and vesical tumors.

Cystitis sometimes occurs during the course of infectious diseases, particularly the specific fevers.

Pathology and Morbid Anatomy.—The micro-organisms which may produce cystitis are many. They include the gonococcus, the bacillus coli communis, the ordinary micrococci of suppuration, and the bacillus of tuberculosis. In many instances the infection is not a simple one, several varieties of micro-organisms being etiologically active. The bacillus coli communis is the one most frequently found. Notwithstanding the frequency with which gonorrhœa is the starting point of acute cystitis, the gonococcus itself appears to play but an unimportant part. The pus from the bladder in such cases contains but few gonococci. These micro-organisms in experimental investigations have failed to produce cystitis by direct inoculation in the bladder. Gonorrhœal cases are always found to be associated with infection by other micro-organisms than the one special to that disease. The so-called tubercular cases are also probably examples of mixed infection. The bacilli first excite a local tuberculosis, which lesion affords a suitable nidus for infection by other organisms than the tubercle bacillus.

The pathological changes in cystitis may be found in any portion of the bladder walls. In most instances, the mucous membrane alone is invaded. That structure exhibits an undue redness with swelling and œdema; small hæmorrhagic extravasations may even be observed. The urine is acid in reaction, but decomposes rapidly, and contains pus and vesical epithelium in variable quantity according to the severity of the case. When the epithelial destruction is sufficiently great, small ulcerations may be seen.

Sometimes the inflammation extends to the muscular coat of the bladder, and it may then happen that small shreds of muscular tissue are cast off and appear in the urine. The swollen muscular tissue causes an abnormal roughness of the overlying mucous membrane. It may be that small abscesses form within the walls of the viscus; or suppuration may become general and the entire organ be converted into a suppurating mass. The urine then becomes highly ammoniacal and swarms with micro-organisms in great variety. The quantity of pus and altered epithelium discharged *per urethram* is large. Recovery from cystitis with involvement of the muscular coat of the bladder is very apt to be attended by the formation of excessive connective tissue deposit; in other words the bladder walls undergo cicatrization. This results in lessening the capacity of the organ.

Symptomatology.—The manner of onset of a cystitis is by no means uniform. In some cases it is rapid; in others it is slow. The essential symptoms of the disease are the appearance of pus and epithelium in the urine, vesical pain and frequent urination. The frequency of micturition varies greatly in different cases. In some it may be only a slight desire, while in others it amounts to an almost constant torturing urging to urinate; so constant may it be that the patient is obliged to keep a urinal handy, into which the urine dribbles almost constantly. The urging to urinate is sometimes increased at night, and in cases of cystitis associated with calculus it is especially severe on slight jarring. The pain in cystitis may be constant, manifesting itself as a soreness or sense of discomfort over the pubis, or be deep in the perineum. It is apt to become intensified at the beginning of the act of micturition owing to contraction of the sensitive bladder walls. Micturition may be accompanied by tenesmus vesicæ and even by marked rectal urging. The discovery of pus in the urine is essential to the diagnosis of cystitis. Its quantity will vary according to the case. When present in small quantity it gives a slight cloudiness to the urine. In extreme cases it settles rapidly, the sediment constituting a very large proportion of the fluid passed. In using the three-glass test, as described in the article on pyuria, it will be found that while the urine in the first glass may contain a relatively larger quantity of pus than the others, pus is always found in the third glass. The increased quantity of pus in the first glass is due to the presence of that substance in the urethra, from which situation it is washed out by the first urination. When the urine is ammoniacal, the discharged pus is glairy and stringy. Blood is sometimes found in the urine in cystitis, and is strong presumptive evidence of the acuteness of the inflammation unless it is the result of associated lesions. Hæmaturia is not, however, a necessary phenomenon of bladder inflammation. The blood may be in sufficient quantity to form its own layer in the urinary sediment. It usually arises from rupture of small superficial vessels. The presence of hæmaturia is sometimes of diagnostic value. Coming before the onset of inflammatory symptoms it suggests the pre-existence of other vesical disease. The full significance of the presence of blood in the urine has already been elaborated in the article on hæmaturia (see page 362). Albumin is present when the quantity of pus is sufficient to excite that symptom. Otherwise its presence is suggestive of renal complications. In some cases the urine undergoes ammoniacal fermentation, this change intensifying the inflammation already existing.

Diagnosis.—The diagnosis of cystitis should present no difficulty. Indeed, a mistake would seem impossible if proper care be taken in making examinations and in giving opinions. The practice of designating every slight vesical irritability "cystitis" is altogether too com-

mon, but may be avoided if inquiry is directed to the presence or absence of pyuria. "No pyuria, no cystitis," is a safe axiom; but this assertion must not be taken to mean that pyuria proves the presence of cystitis, for pus may originate in any portion of the urinary tract. When, however, pyuria exists in conjunction with vesical pain, frequent micturition, or both, the diagnosis of cystitis may be regarded as established. The three-glass test and the reaction of the urine (see article on pyuria, page 360), also afford strong corroborative evidence. The history of the case is also of importance, for we should be able to discover some of the causes which give rise to cystitis, *e. g.*, in the young, gonorrhœa; in those of advanced years, enlarged prostate, the employment of urethral instruments, etc.

Prognosis.—The prognosis of cystitis may be regarded as favorable. All cases should, if proper care be taken, end in recovery. Of course if the patient disregards hygienic rules, and if the exciting cause is not removed, recovery is retarded or even prevented. Cases dependent upon irremovable causes, as enlarged prostate, can only be alleviated.

Treatment.—The first factor in the management of cystitis is absolute rest. The patient must be put to bed and kept there until all vesical irritability vanishes. Inasmuch as concentrated urine is more irritating to the bladder and decomposes more readily than that of less gravity, it is important to have the patient drink freely. He should partake of pure spring water or of distilled water in large quantities, *i. e.*, three or more pints daily, and should as far as possible confine himself to a milk diet. Under no circumstances should meats or highly seasoned food be permitted. Alcoholic stimulants of all kinds are decidedly harmful and should be positively prohibited until long after recovery has been established. Under no circumstances is local treatment permissible when the cystitis is associated with urethritis or prostatitis. The introduction of instruments only intensifies the inflammation. The propriety of rendering the urine alkaline is a question which each physician must settle for himself. Some authorities advise the administration of bicarbonate of soda in sufficient doses to maintain urinary alkalinity, while others condemn it. It is probably wise to let each case be our guide; undue acidity is undoubtedly prejudicial to rapid recovery, and alkalinity predisposes to ammoniacal fermentation. In all cases it is wise to maintain the urine in as near an aseptic condition as possible. This may be done by the administration of boracic acid in doses of five grains every four hours. When ano-vesical tenesmus is practically constant and a source of great suffering, great relief is obtainable by the introduction of suppositories into the rectum containing one grain of powdered opium. Ordinarily one of these every night is sufficient; in severe cases one may be inserted as often as every four hours. This use of opium is, however, objectionable and must be but seldom required.

It causes constipation, and the presence of fæcal accumulations in the rectum intensifies the cystitis. The cases for which opium is prescribed are usually relieved if the rest, diet, etc., as above indicated, are rigidly enforced. Much assistance may be gained by the use of hot or cold enemata, and hot or cold packs to the bladder and perineum.

Under all circumstances constipation must be overcome.

Obstinate cases dependent upon well-nigh irremediable causes may demand surgical intervention, especially free incision and drainage. With such this article does not pretend to deal.

In all cases dependent upon obstruction the regular use of the catheter is demanded, and in chronic cases the employment of injections of antiseptic solutions.

In all cases of bladder disease, and especially in cases of retention of urine associated with paralytic affections, the use of surgically clean instruments is imperative. If such a precaution is adopted the danger of exciting cystitis by instrumentation becomes greatly lessened.

The acute form, if not of gonorrhœal origin, is soon subdued by rest, the production of a bland urine, attention to the bowels, diet, etc., which have been recommended. *Aconite* or *gelsemium* may be of service in the early stage if there is much general disturbance, but must soon be supplanted by *cantharis*, which, in minute doses of the third decimal dilution, often affords prompt relief. In more intense forms, such as often result from gonorrhœal infection, I have found *mercurius corrosivus* in drop doses of the third decimal dilution, repeated every two to four hours, most effective. *Cantharis* is also to be considered for these cases. *Dulcamara* is advised when the catarrh is due to cold. I have no experience with it.

In the treatment of chronic cystitis the cause demands most attention. Removal of stricture of the urethra, stone in the bladder, or prostatic disease is the first indication when cystitis is dependent upon any of these causes. Surgical measures accomplish much. Of medicines having a direct influence upon the chronically inflamed membrane, we may employ, of those already considered, *cantharis* and *mercurius corrosivus*, also *boracic acid*, which, in my hands, has proven invaluable. It must be given in doses of five to ten grains several times daily. *Hydrastis* is also an effective medicine when there is much ropy mucus in the urine, not much tenesmus, constipation, and a catarrhal condition of the gastro-intestinal tract. It should be given in the tincture if the dilutions are inoperative. *Terebinthina* may be employed if there is much irritability of the bladder, which cantharis has not relieved. *Pulsatilla* is often indicated by its well-known general symptoms, and exerts a decided influence over bladder catarrh. As in chronic catarrh in other regions, *sulphur* is useful at some period of the treatment of most cases of cystitis.

Aside from these remedies, *cannabis sativa* may be considered for gonorrhœal cystitis, *chimaphila* is commended by Hughes, particularly for the chronic form; *colocynth* may relieve when urination is attended by extension of the pain to the abdomen, and *pareira brava* when the pains are violent, extending into the glans penis and the urine contains large amounts of ropy mucus. The tincture should be employed.

Indications may arise for *apis*, *arsenic*, *belladonna*, *erigeron*, *kali carb.*, *lycopodium*, *nux vomica*, *populus*, *sepia* and *uva ursi*.

ENURESIS.

Synonyms.—Incontinentia urinæ.

Definition.—The term enuresis, as ordinarily used, signifies an involuntary passage of urine occurring as an idiopathic or functional disorder. Strictly interpreted, it includes involuntary urination arising from any cause.

Varieties.—The classification of cases of enuresis is based entirely on the manner of appearance of this symptom. Thus we have *enuresis continua*, in which the symptom is present both night and day; this is also called *enuresis nocturna et diurna; enuresis nocturna*, in which the involuntary escape of urine is at night only; *enuresis diurna*, in which the escape is during the day. According to causes we have *enuresis irritata*, due to irritability; *enuresis mechanica*, arising from mechanical causes; *enuresis paralytica*, produced by vesical paralysis; and *enuresis spastica*, due to spasm of the bladder.

Etiology.—Enuresis being but a symptom, it must arise from widespread causes. It may occur in children from any of the well-known causes liable to produce it in adults, among which may be mentioned as of especial importance, vesical disorders and disturbance of the bladder, innervation in various organic and functional diseases of the nervous system. Among the latter epilepsy is of especial importance. It is not a very uncommon thing for this disease to exist for a long time in the form of a wetting of the bed at night. In all obscure cases of enuresis, it is of paramount importance to watch the patient carefully in order to determine the presence or absence of convulsive seizures during sleep. As to local conditions, malformations of the prepuce and glans in the male, and of the clitoris and its hood in the female, are the most important. The practical value of these as causes is shown by the frequency with which the habit is broken up by circumcision or the removal of glandulo-preputial adhesions. Still the importance of this cause must not be over-rated, for enuresis may and does arise from numerous other influences. The condition of the urine has been enumerated as a cause by many observers; but it is found operative in only a limited number of cases. Glycosuria, albuminuria, hyperacidity, vesical catarrh, too highly concentrated urine and polyuria, have been said to excite enuresis, and

are occasional causes worthy of careful investigation. Among reflex causes, the irritation arising from phimosis and adhesions has been mentioned. Very important also is rectal irritation. Children are liable to anal fissure with this greater frequency than is ordinarily believed, and may excite involuntary urination. Ascarides sometimes escape from the rectum, and crawling over the perineum into the vagina, excite severe local irritation, which may produce enuresis, and in some cases, even masturbation. When the latter habit is formed, an additional cause of involuntary urination is added.

Idiopathic enuresis occurring in children has received a variety of explanations. It is held that in early infancy there is no voluntary control over the sphincters. As the child grows this difficulty is gradually overcome, until these muscles attain a perfect functional activity, which is usually between two and three years of age. It is claimed that in other cases, for some unknown reason, the muscular system does not develop properly; the congenital weakness persists for an unnatural time, and enuresis is one of the results. Others believe that the enuresis of children is a neurosis, those giving their adherence to this view including Trousseau, Bretonneau and Ultzmann, certainly high authorities. To use Trousseau's own words: "True enuresis nocturna is a neurosis which consists principally in an excess of irritability and tonicity of the detrusor muscle." Observation of the victims of this trouble in many instances shows that they are of highly neurotic constitution. Many of them are exceedingly bright mentally—we might almost say precocious. Still another view respecting the occurrence of enuresis in children is that it may be caused by a variety of constitutional conditions, such as anæmia, scrofula, etc.

Specialists in different lines have claimed cures from removal of defects in distant organs. It is reasonable to believe that the condition known as aprosexia, arising from obstructive intra-nasal conditions, may so undermine the general health as to cause enuresis; but one feels that the limits of specialistic extravagance have been reached when oculists seriously propose to cure the symptom under consideration by having the little ones wear glasses; and yet I have observed remarkable results from the correction of errors of refraction and muscular inequalities in the cure of enuresis.

Symptomatology.—As a rule the patient brought to the physician for treatment of enuresis is a child, with no other history than that of wetting the bed at night. In some cases weakness of the bladder is observed in the daytime also, especially under emotional excitement, efforts at coughing, etc. When the discharge occurs during sleep the patient is not usually cognizant of the accident until awakened. It is thought that in some of these cases the trouble is due entirely to the sound sleep, which takes away all reflex control over the bladder. Noc-

turnal enuresis is apt to occur even when the greatest care is taken to see that the bladder is properly emptied at intervals during the night, showing that it is the result of loss of muscular control and not of distention. Sometimes the enuresis is associated with neurotic and other symptoms, as already indicated. After the trouble has existed a long time, and the patient has advanced some in age, the mortification arising from the disorder produces a variety of symptoms of a nervous character.

Diagnosis.—The diagnosis of enuresis is an easy matter. The discovery of the cause is very often difficult. The most important question relates to the discovery of any morbid conditions to which the enuresis is secondary. This can only be done by thorough general examination of the patient.

Prognosis.—The prognosis of enuresis nocturna is nearly always favorable. The worst cases in children do not last longer than puberty, by which time the muscles controlling the bladder have, as a rule, gained greatly in strength.

Treatment.—Simple cases do very well on medicinal and ordinary hygienic measures. Many others demand elaborate investigations and painstaking care. Efforts must be made to improve the general health, of which massage, cold sponging in the morning, followed by brisk frictions, the use of easily-digested food, the limitation of foods which demand increased nitrogenous execretion by way of the kidneys, and abandoning of fluids for a little time before retiring at night, are all important. Possible causes in the nature of reflex irritation from the region of the bladder must be removed. It is well that the bowels should be evacuated before retiring. Supper should be light. A study of the actual capacity of the bladder when not overdistended should be made, and the course adopted regulated accordingly. When the natural capacity of the bladder is small, the prevention of distention at night becomes an important matter. Under no circumstances should the little patient be scolded or punished for his infirmity. Such a course only aggravates present or brings on fresh evils.

For a long time I followed Jahr's advice to begin the treatment with *sulphur*, and succeeded in effecting many cures by the use of this medicine. I have seen nocturnal enuresis of ten years' standing cured by a single prescription of this medicine, without any change in habits, diet, or other known reason for its disappearance. Failing with sulphur, it is well to give *equisetum* in the lower dilutions, and, if necessary, in five to ten drop doses of the tincure three times daily. I have reported a number of cures of aggravated cases by this remedy, cases with diurnal as well as nocturnal incontinence. *Valerianate of ammonia* has also given me good results, especially in nervous children—little girls with a hysterical tendency. It may be given in disks medicated with a satu-

rated solution in hot alcohol, or as an elixir. Of the older remedies, *belladonna* may help children who are restless at night, twitch and scream during sleep. *Ignatia* should be considered for the same class. *Benzoic acid* when the urine has a strong odor. *Causticum* has been much employed, and with some success. No especial indications have been given. *Calcarea carb.* is of undoubted value when the child is fat, has a large abdomen, sweats much, etc. *Cina* is equally valuable for children who have at the same time worms. Sometimes *santonine* is more efficient. *Pulsatilla* and *sepia* are recommended for little girls. The latter I have used much when the urinary characteristics of that remedy were present. *Lycopodium* helps some of the uric acid cases. *Ferrum phosphoricum* has given me some excellent results in children who get fever and catarrhs upon slight provocation—a catarrhal diathesis—probably an early development of arthritism.

There are rare cases which do not respond to treatment. The causes are various, as the pathological associations have a wide range. Some have contracted bladders, which are treated successfully by distention with boiled water, the treatment being repeated from once daily to twice weekly.

Sir Henry Thompson advises the use of a flexible bougie, to be passed daily, and this failing, the "instillation" of solutions of nitrate of silver into the prostatic urethra and neck of the bladder, with a syringe and flexible tube. The strength should be from ten to thirty grains to the ounce of distilled water; the quantity injected, about one drachm; the frequency, intervals of one to two weeks. He considers this method of deep urethral injections as highly successful, even in young women of eighteen or twenty.

Belladonna, given in the tincture and in increasing doses until relief or the limit of tolerance is reached, has been the "sheet anchor" of the old school, and is certainly of value when the breaking of a habit is the therapeutic problem.

AFFECTIONS OF THE MALE GENITAL ORGANS.

GONORRHŒA.

Definition.—Gonorrhœa is an inflammation of the urethra dependent upon infection with the gonococcus of Neisser, said infection being acquired in practically all instances by impure sexual intercourse.

The term gonorrhœa is a misnomer, having originally been applied to the disease under consideration because of false ideas as to its nature. It was formerly believed that the discharge resulted from some abnormality of the secretory process, and consisted of semen. "Gonorrhœa" has, however, come into such common use, that the term deceives no one. It has, therefore, retained its place in literature, although the term "urethritis" is nearer correct from a pathological standpoint. The objection to the term urethritis as applied to gonorrhœa is found in the fact that there are several varieties of urethritis; while gonorrhœa indicates a urethritis dependent upon a specific cause. Hence it is sometimes spoken of as "specific urethritis."

Etiology.—The etiology of gonorrhœa is summed up in a few words, namely, infection during impure intercourse. Cases are not infrequently encountered in which mythical causes, as urinating in the night air, contact with a dirty water-closet, etc., are urged by the erring sufferer; but knowing well the mendacious character of many of these patients, one can not place much dependence upon their protestations of virtue.

Infection undoubtedly takes place more readily in some cases than in others. The gonorrhœal virus finds its best soil for dissemination in an alkaline medium. This is usually found in the urethra during conditions of high sexual excitement, at which time the normal acid reaction of the urethral mucus is overcome. It seems, too, that urinating timmediately after intercourse lessens the risk of infection, and Martin, of Philadelphia, believes that the danger of contracting the disease is reduced to a minimum when intercourse is followed immediately by urination, the individual during the latter act distending the urethra by constricting the meatus urinarius.

A few words concerning the urethral inflammations which simulate gonorrhœa are here in order. In very many of these cases the trouble is found to arise in persons who are really the victims of uncured gonorrhœa, the discharge being re-awakened under the influence of dissipation or contact with non-specific vaginal discharges. Cases also

occur in which there is no possibility of gonorrhœal inflammation ever having existed, and in which the trouble seems to ensue upon the gouty or rheumatic diathesis, alcoholic indulgence, excessive intercourse, contact with leucorrhœal or menstrual discharges, and tubercular disease of the urethra.

Very carefully pursued investigations negative the idea that gonorrhœa can be acquired in any other way than by infection with the specific discharge of that disease. This statement is made in full knowledge of the claim that women who communicate the disease sometimes exhibit no apparent manifestations of the disorder. In men it is usually limited to the urethra; in women, it may invade the uterine cavity and the fallopian tubes, giving rise to serious pelvic disorders without marked evidence of the disease in the lower genital tract. Again, women may be carriers of contagion without being themselves attacked. Recognizing the pernicious effects of this disease on women, Noeggerath made the statement, which was at one time regarded as emphatically overdrawn, that gonorrhœa was the cause of nine-tenths of the pelvic diseases of women.

Symptomatology.—The first manifestations of gonorrhœa may occur at any time between the first and the fourteenth day after the impure intercourse. Three days is the usual period of incubation; in very few cases is the appearance of urethral symptoms delayed longer than a week. The first symptom noticed is a slight burning on urination, especially marked near the glans penis. At the same time the urinary meatus is observed to be red and puffy, the urethra is tender upon pressure, and a discharge appears which, in the very beginning, is of a mucous character, but soon changes to a thick purulent matter. The pain increases in intensity and may reach a height sufficient to cause great suffering especially during micturition. The urethral pain may at times consist of a more or less constant desire to urinate. The mucous membrane of the urethra becomes swollen, thus narrowing and distorting the canal. The urine may therefore be discharged in spurts or drops, or as a twisted or forked stream. A very distressing, and, unfortunately, a common symptom, is chordee. This consists of painful erections, the infiltrated condition of the urethra preventing its participating in the general distention of the penis, hence the traction exerted upon it leads to curving of that organ downwards. The chordee is usually worse at night; exceptionally, it may be constant. It is a source of great suffering and may deprive the patient of all sleep. In some cases seminal emissions occur.

The acme of the disease is usually reached by the twelfth to the twentieth day. As to the time at which recovery or improvement is to be expected, much depends upon treatment, and the existence or not of complications. The pain gradually lessens; the discharge becomes thinner and less purulent, and finally disappears.

The period during which a gonorrhœa remains dangerous to those coming in contact with the patient is an important practical question. One can safely state that every gonorrhœal patient is dangerous until thoroughly cured, that is until every vestige of discharge has ceased. It is not an uncommon thing for patients to have an agglutination of the urethral orifice every morning for years. It should be borne in mind that that drop is dangerous, bacteriological investigations having demonstrated the presence of gonococci. These patients are also liable under the influence of certain exciting causes to have the old discharge reawakened.

Diagnosis.—In the majority of cases the diagnosis of gonorrhœa is an easy matter, for patients recognizing the importance of telling their medical attendants the truth, give a straightforward history. In some cases, however, such a history is not forthcoming, and one is obliged under such circumstances to await developments, or institute a bacteriological examination of the discharge. The ordinary non-specific inflammations of the urethra usually subside spontaneously in the course of a few days—nearly always within twelve days.

A very simple method of staining the gonococcus, which is well suited to clinical work, has recently been devised. A portion of a drop of the suspected pus is spread in a thin layer between two cover glasses, which are separated and permitted to dry by exposure to the air for about ten minutes. One is then held with forceps and passed rather slowly over a Bunsen burner or alcohol flame two or three times with the specimen side turned upwards. Next, the staining solution is applied to the preparation and permitted to remain for a couple of minutes, after which it is washed off with a stream of cold water. The cover glass is then placed on a slide, still wet, and examined under a twelfth immersion objective, with good illumination secured by aid of an Abbé or other condenser. The staining fluid is prepared by adding to a watch crystal containing water, a small quantity of a saturated solution of methylene-blue in alcohol. The gonococcus is a variety of diplococcus, appearing in pairs or fours, each constituent consisting of a coffee-bean-shaped spot, with its straight side turned towards its neighbor. It is indistinguishable from similar micro-organisms, excepting by its behavior to staining solutions. It differs from all others in that the stain is removed by washing with alcohol.

Complications.—The complications of gonorrhœa are quite numerous, and in some cases constitute a serious feature. Acute cystitis has already been considered in a special section (see page 455), and need not be mentioned at this time. It is not, however, as frequently encountered as posterior urethritis, or inflammation of the deep urethra. This complication does not, as a rule, assert itself before the third week of the attack. It is usually brought about by alcoholic or sexual indulgence, or

by direct infection produced by injections or the passage of instruments. It is a serious complication because it retards cure, and in some cases causes the trouble to continue for an indefinite period. On the contrary its appearance sometimes gives rise to no additional symptoms. Usually there are sensations and pains referred to the perineum associated with increased urging to urination, sexual irritability and seminal emissions. Digital examination by the rectum discovers a tenderness along the line of the deep urethra. If the two-glass test be employed, the urine in both glasses contains pus; that in the first consists of the washings of the urethra *plus* urine; that in the second, the pus from the posterior urethra, which naturally flows backwards into the bladder, *plus* urine. It is, therefore, necessary to negative the existence of cystitis. In the latter affection pus may be discovered after only a short retention of urine. In posterior urethritis the urine after short retention may be clear, but contains pus after remaining in the bladder for a long time, *e.g.*, over night.

Epididymitis is likewise a frequent complication of gonorrhœa. It occurs in about one-sixth of the cases of that disease. It is especially apt to occur in cases associated with posterior urethritis. It is now believed to result from direct extension of infection along the ejaculatory ducts, seminal vesicles and vasa deferentia, or indirectly through the lymphatics. Like posterior urethritis it appears with greater frequency during the third or fourth week of a gonorrhœa. It makes itself known by swelling, heat, redness and pain. The swelling is of rapid onset and may attain a size two or three times that of the normal testicle. Coincident with the appearance of the epididymitis the urethral discharge diminishes.

Acute prostatitis manifests itself by severe pain in the perineum and painful micturition. Digital examination by the rectum reveals the presence of a greatly enlarged prostate, which is sensitive to touch. There is some fever, although the temperature rarely rises higher than 101° F. In some cases the inflammation terminates in suppuration, this additional complication being manifested by chills, sweats, and the characteristic temperature curve of suppuration. In some cases the inflammation and suppuration may involve the structures surrounding the prostate. Acute prostatitis is a serious complication by reason of the frequency with which it impairs the sexual functions.

Balanitis or inflammation of the mucous covering of the glans and prepuce is usually the result of lack of cleanliness. It displays itself by heat, swelling and pain in the inflamed parts. It is sometimes associated with great preputial œdema and a free discharge.

Other complications of gonorrhœa are vesiculitis, pyelitis, cowperitis, and peri-urethral inflammation.

The most important of the sequelæ of gonorrhœa is stricture.

Prognosis.—The prognosis of gonorrhœa is, as a rule, favorable,

properly treated cases, free of complications, recovering in from four to six weeks. Death has occurred from general pyæmia. Complicated cases may be of indefinite duration. The after-consequences of gonorrhœa are far more serious than has been supposed. Strictured urethra constitutes a very important cause of many of the obstinate cases of chronic cystitis and incurable diseases of the kidneys. In rare cases inflammation of joints may follow (gonorrhœal rheumatism).

Treatment.—In no disease have more methods of cure been proposed than for gonorrhœa. Authorities have advocated, on the one hand, a purely expectant plan, while others equally eminent have urged the most active abortive measures. As usual, when extremes are arrayed against each other, a medium course is wise. The most important point in the management of the patient is rest, which should be made as complete as the circumstances of the patient will permit. Under no circumstances should sexual indulgence be permitted. It is well if the patient can be induced to take to his bed. Such a course will most certainly lessen the frequency of complications if it does not avoid them altogether, and greatly shorten the duration of the attack. The diet should be as sparing as possible, as by this course the nitrogenous excretion by the kidneys is lessened and the urine rendered less concentrated. Animal food in particular should be avoided. Water should be freely indulged in. Vichy is admirable and favors free action of the bowels. If the patient is willing to go upon a milk diet, so much the better. Under no circumstances should even the mildest alcoholic beverage be permitted. Tea, coffee, etc., should be dispensed with. Tobacco probably has a bad effect. The prepuce and glans must be kept scrupulously clean. Some words are here necessary regarding the toilet of the penis. It is altogether too common a custom to envelop the penis in rags, which are held *in situ* by a string which binds the organ, which is injurious. The best dressing consists of a piece of absorbent cotton tucked into the space between the glans and the prepuce so as to catch and absorb the discharge. It should be renewed frequently. Another good dressing is the wood-wool gonorrhœal pouch. Hot sitz-baths for half an hour each day will be found a very valuable adjuvant in reducing the intensity of the urethral inflammation.

As to injection treatment many plans have been proposed, but with few exceptions all seem to be open to serious objections. The early injection treatment need only be mentioned to be condemned. Even if injections of strong solutions of nitrate of silver destroy the gonococci and bring about a prompt cessation of symptoms, the after-consequences of such a treatment and the risks incurred are sufficient to make it inadvisable. Not only may such a course increase the liability to the various complications enumerated above, but the probability of stricture of the urethra as a sequel is much increased. Hot water retrojections may be

permitted, but can be given by the physician only. Water at a temperature of 110° F. is placed in a reservoir and permitted to irrigate the urethra through a moderate size soft catheter, which should not be introduced further than the pendulous portion of the tube. As it escapes from the orifice of the instrument it flows outward, escaping at the meatus by the side of the instrument. The irrigations may be made once or twice daily. The water may sometimes be advantageously medicated with mercuric chloride in the proportion of one to ten thousand.

Late in the course of the disease, when all symptoms of irritability have disappeared, yet the discharge continues, weak permanganate of potassium solution may be injected daily, or sulphate of zinc in a strength of one to three grains to the ounce of water.

Cases of gonorrhœal epididymitis should be treated by absolute rest in bed. The inflamed testicle should be well supported by a properly constructed suspensory. Hot applications frequently renewed give great relief. In indolent cases, *i. e.*, when active inflammatory symptoms have subsided, but the swelling does not abate, strapping of the testicle with adhesive plaster is good practice.

Prostatitis requires absolute rest in bed and the adoption of all the measures recommended in cystitis. Care should be taken lest suppuration occur without being suspected. In such cases the pus is apt to escape either by way of the rectum or the urethra. In either case protracted illness may result. When pus forms, the surgeon should be called upon to evacuate it by way of the perineum.

During the early stage of gonorrhœa the acute hyperæmia may be much lessened by the use of *aconite* internally. It is most efficient in drop doses of the tincture of the root, repeated every two or three hours. My own experience favors *gelseminum* at this stage. It is also of benefit for a longer period of time than aconite, *i. e.*, after the inflammatory process is fully established. It should be given in tablets representing one minim of the tincture every one to three hours. With proper accessory treatment this remedy is often sufficient to modify and shorten the course of the attack. With subsidence of acute pain, and of the evidences of intense hyperæmia, it usually becomes necessary to select another medicine. *Cannabis sativa* has long been esteemed for this stage, but I have not been impressed by its favorable action. It is advised by most observers to give it in the tincture freely. Even many of those accustomed to the use of high dilutions advise the lower ones of this remedy. Neither has *cantharis* appeared able to modify the symptoms except where the inflammation had penetrated the deep urethra and bladder. Better results have followed the use of *mercurius corrosivus*, particularly in active cases attended by much pain and urging. In those of milder character with a profuse creamy, yellowish or greenish discharge, *pulsatilla*, in the tincture, sometimes gives admirable results.

This remedy, followed by *clematis*, if necessary, is of first importance in the treatment of the orchitis which so frequently arises. For the late stage, after the cessation of pain and the profuse discharge, many remedies must be considered. It is at this period, and later, that the general health must be surveyed, and when any condition likely to protract the disease should receive attention. It is not uncommon to discover an arthritic diathesis, which is a prominent cause of chronic urethral disease. Its treatment is the same as when dissociated with gonorrhœa. The persistent use of enough distilled or other pure water to secure a thoroughly bland urine is essential to improvement. Many remedies have been suggested for the treatment of gonorrhœa, which is good evidence of the inefficiency of most of them. For the gleet, which so frequently supervenes, an equally large number of medicines are commended, and it must be confessed that they are often of much service relieving symptoms which most skilful surgical attention has failed to entirely remove. *Benzoic acid*, *graphites*, *hydrastis*, *lycopodium*, *petroselinum*, *senecio*, *silica*, *sepia*, *sulphur* and *thuja* should be studied in this connection.

ABNORMAL SEMINAL DISCHARGES.

The abnormal seminal discharges, for which the physician is often consulted, include: (1) nocturnal emissions, characterized by discharge of semen during sleep, and generally accompanied by a dream of erotic character; (2) diurnal emissions, in which the discharge of semen occurs during the waking moments, but not provoked by the usual mechanical excitation of emission (*i. e.*, masturbation or intercourse), which are accompanied or not by erection and erotic sensations; and (3) true spermatorrhœa, in which the discharge is passive, the semen escaping without erection or sensation. In each of these varieties of abnormal seminal discharges, the same etiological factors are at work, the resulting phenomena depending upon the extent to which the exciting causes have been carried, and the natural bodily vigor of the patient.

Nocturnal emissions are unquestionably the most commonly observed. They are, moreover, the form which is the most readily cured. In many cases, it might be said in the majority of cases, they are purely physiological, acting as a vent by which the sexual passion is allayed in the absence of natural means for gratifying the desire. The line of demarcation between normal and abnormal frequency of nocturnal emissions is not readily defined. What is pathological in one patient is perfectly physiological in another. The man whose occupation necessitates hard manual labor is not likely to have emissions with anything like the frequency to which the individual of sedentary habits is accustomed. The previous habits of the patient also enter into the question. The man accustomed for years to regular intercourse, when deprived of the same,

will have frequent emissions, which must be regarded as physiological for a time at least, or until he has become accustomed to the new order of things. Frequency of emissions cannot then be taken as the standard for judging as to the abnormality of the symptom. The best measure is the effects which the emissions produce on the subject. If he experiences a sense of comfort thereby, they must be looked upon as physiological; if, on the other hand, he feels tired and uncomfortable on the following day, they are pathological.

Diurnal emissions and spermatorrhœa are always pathological.

A variety of diurnal emission which is not uncommon, and which is perfectly physiological within certain limits, is the escape of semen during violent efforts at stool. To be a normal phenomenon, it must not be a regular one, and the straining which produces the discharge must be more than the effort required to produce an easy evacuation of normal bowels. The phenomenon, when within the bounds of health, does not differ from the simple act of stripping the seminal vesicles excepting that it is the pressure of the hardened fæcal masses which cause the discharge, instead of the finger of the examining surgeon.

These remarks concerning the value of seminal discharges as evidence of ill health, are of great practical importance, for there are thousands of men who have been plunged into a life of hypochondriasis, because of worry over a physiological phenomenon, worry often produced and kept alive by the quack literature and advertisements with which the country is flooded. It is a matter of daily observation that the greatest sufferers from this evil are not the men whose habits have been worse than the average; indeed, one often finds that their bad habits have been of short duration.

Etiology.—The most important etiological factor of seminal emissions in all their varieties is sexual excess. What constitutes sexual excess? This term must be regarded as a purely relative one. What is normal for one is abnormal for another. The best criterion is that of effect. If indulgence produces no lassitude, no backache, no headache, but instead a feeling of well-being, the act cannot be regarded as excessive. The manner of indulgence is undoubtedly an important point. Artificial means of excitation, as masturbation, are undoubtedly more baneful than natural intercourse. This statement is made, however, with the feeling that the ill effects of masturbation, bad as they are, have been greatly overdrawn. As a rule they disappear promptly on the cessation of the habit. Were it otherwise, the country would be full of sexual hypochondriacs owing to the commonness with which youths practise onanism. The harm arising from that act, as compared with excessive intercourse, may be thus explained. The practice is begun at an early age, when the subject is growing, and needs every resource for the building up of the man. There being but one party to participate in the act, there are more

frequent opportunities for its performance, and it is therefore practised more frequently. Finally, the excitement produced is an artificial one, and comes in response to perverted mental impulses rather than from a physiological sexual craving, and the resulting sexual orgasm is more exhausting in its effects.

Whether or not it is the actual loss of semen which produces the symptoms so commonly observed in the victims of seminal discharges it is impossible to say. I am of the opinion that the causative factors are manifold. The sexual orgasm itself is followed by a temporary exhaustion by reason of nerve discharge, if I may be allowed the use of the expression in this connection. Added to this is the actual loss of semen. In the case of unnatural practices, the exhaustion from the stimulation is greater than in natural gratification, and there is also a mental factor arising from the forfeiture of self-respect produced by this solitary vice.

Continence has been named as a cause of seminal losses in many instances. If by continence is meant non-indulgence, coupled with healthy morals, the statement is false. A life of continence is physiological. If, however, the individual avoids indulgence, but at the same time permits his mind to dwell on sexual subjects, seminal discharges are liable to follow. Such a person must, however, be regarded as a mental masturbator. People of this class are only too common. They read quack literature and erotic novels, and keep themselves occupied with sexual thoughts. Under such circumstances the occurrence of emissions is not surprising.

Local lesions are responsible for some cases of involuntary emissions. These include phimosis, stricture, spermatocystitis, etc.

Symptomatology.—The average case of seminal weakness gives a history of abnormal sexual indulgence carried to a greater or less extent. While the habit was still in existence, or after its abandonment, nocturnal emissions began. These recurred at intervals varying considerably in frequency, but usually followed by general physical and mental exhaustion. The intervals between the discharges become shorter as the disease progresses, until, in some cases, they may take place almost nightly. The erectile powers, which were normal at first, gradually become enfeebled, until finally power may have been entirely lost. At first the discharge is accompanied by normal sensations, but in advanced cases the emission may be without sensation or lascivious dreams.

During the waking hours the patient may be perfectly well aside from the hypochondriacal mood and the lassitude so commonly observed. In other cases there may be a sexual erethism. Mere companionship with a woman, without contact, being sufficient to excite erection and discharge; or mechanical friction of the genitals against the clothing, *e. g.*, as in horseback riding, produces emissions. In some sexual neurasthenics very peculiar methods of irritation bring about an orgasm.

Some respond to shampooing, some to a mere handshaking with a particular individual; some to the passage of a bougie, and others to mechanical causes equally as peculiar as those just mentioned.

Some of these patients present no mental symptoms, and cases of this character may be regarded as having a favorable prognosis, but in the majority the wildest delusions respecting the sufferer's sexual condition prevail. The extent of the patient's knowledge and ordinary good sense does not seem to curb his wild fancies in the least. Be he a doctor or layman, his fears of "loss of manhood," sterility, testicular atrophy, insanity and numerous other ills, are equally great.

In advanced cases, and these fortunately are very rare, a true spermatorrhœa occurs. The semen flows passively during the waking hours without excitation of any kind.

The influence of seminal weakness on the quality of the semen varies in different cases. In the average mild case no changes are observed, but in long-standing severe cases, the semen becomes watery in consistency and the sepermatozoa diminished in number or lessened in their vitality. It is not uncommon for the urethra, and especially its prostatic portion to become hyperæsthetic. Regarding the method of obtaining a specimen of semen for examination it may be stated that there is but one satisfactory way of securing it. This consists in the physician expressing the required specimen from the seminal vesicles by manipulation or pressure exerted from within the rectum.

The constitutional effects of seminal emissions are evident in the hypochondriacal state already mentioned, and in a great variety of sensory phenomena. The latter include every conceivable anæsthesia and paræsthesia. As to the possibility of organic diseases of the nervous system resulting, *e. g.*, locomotor ataxia, epilepsy, etc., we are inclined to reply in the negative in the absence of direct evidence establishing the contrary view.

Diagnosis.—The main question in the diagnosis of seminal troubles relates to the determination of the extent to which the symptoms are due to actual local conditions, and as to how far they are the result of purely dervous or mental causes.

Prognosis.—In the vast majority of cases, especially those free from mental symptoms, the prognosis is favorable, the emissions disappearing promptly on the institution of a hygienic life. Cases of spermatorrhœa on the other hand are unfavorable in their outlook.

Treatment.—As a preliminary step it is essential to disabuse the patient of erroneous ideas which he may hold as to his condition and thus restore confidence. A hard mattress should be selected, and the bed covering should be light. Heavy meals in the evening must be avoided, and as far as possible the mind be diverted from sexual thoughts. Literature upon this subject should not be read. Cold bathing in the

morning, plenty of exercise in the open air and everything calculated to elevate the plane of general health should be employed. Nocturnal emissions are often excited by certain positions, especially that upon the back. I have repeatedly checked frequent emissions excited in this manner by placing about the waist a towel knotted in the back.

The diet should be simple, nutritious and free from stimulating articles such as coffee. The bowels should be kept in a free condition, as constipation is highly prejudicial.

While the individual is still sexually strong, *i. e.*, has firm erections, emissions with dreams, which usually cause him to awake, excellent results may be obtained from *gelsemium* in the lower dilutions or tincture, and occasionally *aconite*, given in the same manner. *Nux vomica* follows well, and is of decided value in many cases. It had better not be administered lower than the third dilution. *Cannabis indica* may be compared if the sexual desire is excessive. Also *picric acid.* I have observed good results also from *digitaline*, recommended by Bähr and Hughes for frequent nocturnal emissions without especial symptoms.

If sexual desire is intense, erections rather painful, and especially if the deep urethra is inflamed, *cantharis* is advisable.

With loss of sexual ability, *i. e.*, feeble erections or an absence of erections, loss of sensation during emissions, emissions during the day with little excitability, etc., no remedy is comparable with *strychnine*, which should be given in grain tablets of the second decimal trituration from three to six times daily. If the patient is exhausted physically from frequent emissions, and especially, according to Hahnemann, if excited by masturbation, much good may come from *cinchona*, which often acts well even in the dilutions. Although the physical ability for intercourse has disappeared, there are still lascivious fancies. If the nervous system is more at fault, *phosphoric acid*, *phosphorus*, or *strych. phos.*, is more useful. *Sulphur* finds a place in the treatment of most protracted cases. It is useful after *cantharis.*

Other medicines commended for abnormal seminal discharges and which have proven valuable, are *staphisagria* for spermatorrhœa with hypochondriasis; *conium* for excessive irritability, emissions upon the slightest provocation. The sexual desire is strong, the physical ability slight. *Agnus castus*, when emissions are associated with loss of sexual desire, as well as of physical ability; loss of memory. *Anacardium* should be compared with the former remedy.

Whether the remedies suggested, or others are prescribed, it is all important to carefully observe proper rules respecting food, sleep, exercise, mental habits, etc., and to remove any local conditions which may be provocative of the seminal loss. If the deep urethra is the seat of chronic inflammation, local treatment may be required. Excellent results often follow the gentle insertion of a cool steel sound once or

twice weekly. Other local treatment more difficult of application had better be left to a specialist, as it is easy to do more harm than good. As oxaluria or lithuria may be provocative of emissions, the urine should be examined in all cases. Plenty of pure water should be taken to ensure bland urine. The possibility of masturbation or injudicious association with females continuing the symptoms must be kept in mind.

AFFECTIONS OF THE MOUTH.

STOMATITIS.

Definition.—Inflammation of the mouth.

The definition of stomatitis given is a generic one, including quite a variety of inflammatory processes involving the mucous membrane of the mouth, tongue, lips and palate. According to the character of the inflammation, stomatitis is designated catarrhal, aphthous, ulcerative and mycotic.

SIMPLE STOMATITIS.

Synonyms.—Catarrhal stomatitis; erythematous stomatitis; acute stomatitis.

Definition.—A form of inflammation of the mucous membrane of the mouth, unaccompanied by ulceration.

Etiology.—In this, as in the other varieties of stomatitis, age is a prominent predisposing factor, for, although adults are by no means exempt, a very large majority of the cases occur in infants and very young children. The general state of health also exerts an important etiological influence, for the exciting causes of the disease are less active in perfectly healthy children. The disease is not infrequently a forerunner or an accompaniment of the acute febrile diseases of children, but especially of the exanthemata, notably scarlet fever, measles, etc., the characteristics of stomatitis impressing themselves on the associated buccal changes.

The exciting cause of stomatitis is local irritation, which may be either mechanical, thermal, or chemical. Dentition is very frequently assigned as a cause, but the trend of opinion is to the view that this cause can be operative only in children of depreciated constitution. The presence of a sharp or broken tooth, prolonged sucking at an empty breast, too hot or too cold food, the hot and irritating fumes of tobacco, excessive indulgence in alcoholic beverages, lack of cleanliness, alveolar abscess and the various diseases of the teeth and gums, of which the most important, clinically, is pyorrhœa alveolaris, also poisoning with certain drugs, as arsenic, lead, mercury, and corrosive substances, are all occasional causes.

Many cases appear to be the result of an intestinal or gastric disorder. It is now generally believed that the mucous membrane of the

mouth possesses both excretory and secretory functions, and that owing to the perverted digestive processes, the fluids of the mouth acquire irritating properties.

Exposure to cold is an occasional cause, as seen in the cases accompanying coryza. Stomatitis is sometimes associated with tonsillar affections, and may be a disorder of lactation or pregnancy, occurring during the latter periods mainly as a symptom of the not infrequently associated debility.

Pathology and Morbid Anatomy.—The characteristic lesion of stomatitis is attended by bright redness of the buccal mucous membranes. The changes are either diffused or circumscribed. The secretions of the mouth may be either diminished or increased in quantity. Quite often the bright redness is interspersed with white patches, these being due to the accumulation of desquamated epithelium at these points. Sometimes the mucous membrane of the cheeks is œdematous, in which case the affected part takes the imprint of the teeth. The swelling and inflammation sometimes lead to closure of the orifices of the muciparous follicles, which thereby become distended by their confined secretions. The bloodvessels are frequently so distended as to rupture. Blood may be forced into the submucous tissues and undergoing changes, give rise to various discolorations.

Symptomatology.—The objective symptoms of catarrhal stomatitis have been stated. The usual concomitants of inflammation—pain and heat—are, of course, present. The patient, if a child, is fretful. It makes attempts at nursing, but soon drops the nipple in pain. The flow of saliva is usually increased. It is acid in its reaction, and with the exception of an abundance of epithelium and leucocytes, presents no other changes. In adults, pain on mastication is experienced; the breath is offensive, and taste disturbed. Many cases are accompanied by gastro-enteric disturbances, as diarrhœa, dyspepsia, etc. In infants, the submaxillary lymphatics are sometimes enlarged. In some few cases, severe constitutional disturbances attend the local condition, prominent among these being convulsions and high temperature.

Prognosis.—So far as the condition of the mouth is concerned, the prognosis is favorable, nearly all cases making a complete recovery within a few days. Sometimes the local trouble so interferes with alimentation as to cause serious disturbance of nutrition. This naturally reduces the patient, and if prolonged, may prove a serious matter. The associated diarrhœa may prove obstinate if its cause is not understood. In some cases there is a tendency to recurrence. The possibility of tubercular infection has been suggested in cases with marked glandular involvement.

APHTHOUS STOMATITIS.

Synonyms.—Aphthous sore mouth; follicular stomatitis; herpetic stomatitis; angina aphthosa; vesicular stomatitis. The nomenclature of aphthous stomatitis is in a state of sad confusion. Many synonyms are given, most of which apply properly to other varieties of mouth inflammation. Of the above synonyms, follicular stomatitis should have no standing, as the lesions are not follicular, frequently occurring in portions of the mouth entirely free from such structures.

Definition.—A form of inflammation of the mucous membrane of the mouth characterized by the formation of vesicular lesions, which subsequently become transformed into pseudo-ulcers.

Etiology.—As in catarrhal stomatitis, age is an important predisposing factor, the majority of cases occurring in infants and young children, especially, according to Bohn, in those of from eleven to thirteen months of age. Local irritation and infection by micro-organisms have been assigned as exciting causes, but rather by inference than as the result of reliable data. The disease has been observed during the course of certain acute maladies, such as pneumonic fever, intermittent fever, gastro-intestinal catarrh, scarlet fever, measles, etc., and in the terminal stages of exhausting diseases, as phthisis and cancer. Bad hygienic surroundings and constitutional debility certainly favor its occurrence. Cases have, however, been observed in perfectly healthy subjects. Season and weather seem to exert some etiological influence, for more cases are observed during the summer and autumn months and when moist atmospheric conditions prevail. Pepper regards aphthous stomatitis as often the result of local irritation, especially that arising from dentition. Forchheimer, on the other hand—and his views seem more consistent with clinical facts—believes that the disease is produced "by some deleterious material in the circulation, which may have its origin in various processes, bacterial or otherwise. It may, therefore, be of various kinds. This material acts upon a nerve or nerves, or upon a nerve centre or nerve centres, and produces an herpetic eruption which is the aphthous process." The resemblance to herpetic eruptions suggests lines of thought in considering the etiology of aphthous stomatitis.

Pathology and Morbid Anatomy.—Opinions respecting the pathology of aphthous stomatitis vary greatly. Some attribute it to infection by the "foot and mouth disease" of animals, a view that cannot be maintained, for that disease but rarely occurs in this country, while aphthous stomatitis is a common affection. The follicular origin of aphthous stomatitis is negatived by the presence of the aphthæ in portions of the mouth in which the muciparous follicles do not exist. The theory that has the most to commend it is that held by Forch-

heimer, which maintains that the lesions are primarily vesicular. This would seem to make the disease analogous to herpes, and to suggest a possible nervous cause associated with general nutritive disorders.

The lesions begin as slight elevations of the epithelium surrounded by red areolæ. The nature of the exudate beneath is generally regarded as lymphoid, although Stanley Boyd speaks of it as being "solid fibrinous." The raised epithelium is soon cast off, leaving small whitish aphthous ulcers. The edges of these ulcers are somewhat swollen, which gives the appearance of being excavated. At no time is the base entirely deprived of epithelium, consequently it cannot be regarded as a true ulceration. The lesions present great variations in size, are generally discrete, but may be confluent.

Symptomatology.—Aphthous stomatitis may or may not be ushered in by prodromata. These consist of the ordinary symptoms ushering in children's diseases in general, viz., malaise, loss of appetite, vomiting, constipation, diarrhœa, fever, and even nervous symptoms. Some cases develop without the slightest constitutional disturbance. The mouth condition begins rather suddenly with the symptoms of catarrhal stomatitis, followed by the characteristic eruption. The aphthæ may appear in any portion of the mouth, although predominating on the inside of the lower lip and on the tip of the tongue. They may occur either in groups or scattered throughout the mouth, exceptionally appearing even in the pharynx, and rarely in the larynx. The epithelial covering of the vesicles is usually cast off within twenty-four hours, leaving the resulting "ulcerations." In exceptional instances they coalesce and form large patches covered by a whitish exudate, which may give rise to the suspicion that the case is one of diphtheria.

Pain in some degree is always present, and interferes with the taking of food. The saliva is unaffected. The breath is not offensive, presenting an important distinction from ulcerous stomatitis.

Diagnosis.—Aphthous stomatitis may be confounded with ulcerous stomatitis, thrush, and buccal diphtheria. *Thrush* is recognized by its characteristic microscopic fungus, and, moreover its lesions are not surrounded by the red areola of aphthæ. *Ulcerous stomatitis* is accompanied by offensive breath, and the ulcerations are found primarily along the free border of the anterior surface of the gums. If any suspicion as to the presence of *diphtheria* exists, it will usually be dispelled by waiting twenty-four hours.

Prognosis.—This is always favorable. Aphthous stomatitis rarely continues longer than ten days, and the majority of the cases recover in less than a week. Sometimes the lesions appear in crops, so that the course of the disease is considerably prolonged. In these cases lesions in various stages of development are easily recognized. In some rare instances the aphthæ afford opportunities for infection with other poisons.

ULCERATIVE STOMATITIS.

Synonyms.—Phlegmonous stomatitis; putrid sore mouth; stomacace.

Definition.—A form of inflammation of the mouth occurring only in subjects with teeth, commencing on the free border of the gums, attended by considerable destruction of tissue, and never extending to parts outside of the mouth.

Etiology.—Age is an important etiological consideration. It rarely occurs prior to the fourth year, most frequently attacking subjects between the ages of four and ten years. Adults are by no means exempt; epidemics have been reported as occurring where a number of persons have been crowded together, as soldiers in barracks. All the agencies which together make up a bad hygienic life are predisposing causes, notably, poor food, insufficient clothing, bad ventilation and filthy surroundings. Infection is believed to be a cause by many, and is undoubtedly the principal factor in some hospitals and institutions in which the disease occurs epidemically or endemically. In some of the endemics of ulcerative stomatitis scurvy is probably at the foundation of the trouble. Certain acute diseases predispose to it, *e.g.*, measles, scarlet fever, pneumonia, typhoid fever, malaria and whooping cough. Sometimes predisposition is occasioned by constitutional maladies, as syphilis, rachitis or tuberculosis. Season exerts some influence, the damp weather of spring and autumn favoring its occurrence. Certain drugs, as mercury, copper and iodine, are important causes. Mercury is excreted by the saliva, and it is believed excites a stomatitis by its local action. Some cases arise solely from local causes. Lack of cleanliness of the mouth and teeth leads to the accumulation of decomposing food and secretions in the interstices, which gives rise to infection and irritation.

Pathology and Morbid Anatomy.—The beginning of ulcerative stomatitis is characterized by the appearance of a line of inflammation along the anterior aspect of the free border of the gums, generally those of the lower jaw. The pathological process continuing, the affected parts become swollen, the gums recede from the teeth, which may even become loosened, and the affected gums bleed from very slight manipulation. The commencement of the ulceration is characterized by the appearance of a yellow line along the edge of the gums, which rapidly becomes transformed into a band, even including the entire breadth of the gums. The tissue then breaks down and ulceration is developed. The ulceration may extend to any or all parts of the mouth, but it probably never invades the tissues posterior to the palate.

Symptomatology.—Prodromata are nearly always absent. The local appearances have already been described. The pockets formed by the recession of the gums from the teeth afford space for the accumula-

tion of muco-purulent discharges, which become putrid and give the breath and the saliva a horribly offensive odor. Salivation is free and the saliva usually blood-tinged. The saliva is also acid in reaction, and is shown by the microscope to contain débris, leucocytes, red blood corpuscles, and various micro-organisms. The pain, especially when partaking of nourishment, is considerable. In some cases the flowing of the contaminated saliva over the lower lips and the integument of the chin excites an eczema.

The lymphatic glands tributary to the mouth enlarge, although they do not often suppurate.

Diagnosis.—Ulcerative stomatitis may be confounded with aphthæ and noma. The occurrence of the primary lesion along the free border of the gum of the lower jaw is a sufficient point of distinction, excepting in those rare instances in which aphthæ appear first in that situation. In such cases observation of the progress of the disorder for twenty-four hours will afford sufficient data for differentiation. Aphthous stomatitis frequently spreads to the pharynx; ulcerative stomatitis never does. In *noma*, the lesion is accompanied by extensive induration and sloughing of the soft parts about the mouth.

Prognosis.—The outlook in cases of ulcerative stomatitis under proper treatment is favorable. The disease, however, does not exhibit a natural tendency to recovery under expectant methods. By reason of long-continued bad management the ulcerations extend in depth until the periosteum and even the bones are affected. Necrosis then occurs, a large piece of dead bone being found at the bottom of the ulcer. Cases of this character may result fatally from exhaustion. The presence of constitutional complications, as rachitis, syphilis, tuberculosis, etc., should lead to conservatism in framing a prognosis. Some cases become chronic and persist for months.

MEMBRANOUS STOMATITIS.

Synonyms.—Stomatitis diphtheritica; stomatitis crouposa; diphtheria of the mouth.

Definition.—A form of inflammation of the mouth characterized by the formation of a pseudo-membrane, which is cast off in the course of several days, leaving an ulcerating surface.

Etiology.—Membranous stomatitis may occur as either a primary or secondary affection, in the latter case usually succeeding tonsillar or pharyngeal diphtheria. In any event it is one of the rarest of diseases, especially so as a primary affection. Inflammation of the mouth with the formation of a pseudo-membrane often occurs from the local action of corrosive liquids.

Pathology and Morbid Anatomy.—In this as in other varieties of stomatitis, the first manifestations are those of a catarrhal inflamma-

tion, this condition being quickly followed by the appearance of the pseudo-membranous formation. After an existence of from three or four days to a week, the membrane undergoes disintegration and is cast off, leaving an ulcerating surface beneath. It may appear on any part of the mouth. Bacteriological examination discloses the presence of the Klebs-Loeffler bacillus in the true diphtheritic cases, but in order to establish a positive differentiation, inoculation experiments must be performed upon animals.

The cases resulting from the action of caustic poisons are due to a surface coagulation by chemical action.

Symptomatology.—The subjective and objective symptoms, other than those already stated, are similar to those of the other varieties of stomatitis. There are pain, salivation, fœtid breath, admixture of blood with the saliva, and lymphatic enlargements. In some cases there may be hæmorrhage from the mouth, a symptom to be always viewed with alarm.

Diagnosis.—When associated with pharyngeal or tonsillar diphtheria, there will be but little difficulty in recognizing this affection. When occurring as a primary disorder it may through carelessness be confounded with ulcerative stomatitis. In doubtful cases bacteriological examination and inoculations should be employed as the vital question arising in doubtful cases relates to the diphtheritic or non-diphtheritic nature of the case.

Prognosis.—Membranous stomatitis is always a serious affection. Occurring as a feature of diphtheria it is exceedingly grave and calls for a most guarded prognosis. Primary diphtheria of the mouth must be regarded as only less dangerous than the secondary variety. The prognosis of membranous stomatitis arising from caustic poisons depends upon the extent to which the tissues have been destroyed.

GANGRENOUS STOMATITIS.

Synonyms.—Noma; water cancer; cancrum oris; stomatitis gangrenosa.

Definition.—A gangrenous process, usually unilateral, starting on the gums or inner surface of the cheeks, extending rapidly, and effecting the complete destruction of all parts it attacks.

Etiology.—The majority of cases are observed among the poorly fed and constitutionally depreciated inmates of hospitals and institutions; but even under these circumstances the disease is almost sufficiently rare to constitute a clinical curiosity. It apparently never occurs in persons of hitherto sound constitution. While no age exempts, most cases occur in children between the ages of two and five years. Climate and season exert some etiological influence, for noma is more common in damp countries and during the spring and autumn months. Certain

infectious diseases, but notably measles and typhus fever, predispose to its occurrence. The contagiousness of the malady is a debatable point. Groups of cases have been observed in families and hospitals, while very many cases occur in which possibility of contagion or infection seems to be excluded. Some cases arise as the result of previously existing irritation or local disease, ulcerative stomatitis being especially prominent among the latter.

Efforts to isolate a specific germ have not yet proven successful. Thread-like bacilli have been described by Lingard, short rods similar to those found in pulmonary gangrene, associated with streptococci, were found by Cornil and Babes. Other micro-organisms have been observed by other investigators, but none of them have proven to be specifically related to the disease.

Pathology and Morbid Anatomy.—The characteristic lesion of gangrenous stomatitis usually starts as a small blister on the inner surface of one cheek or upon the gum. The lesion spreads very rapidly, extensive induration with destruction of tissue following. The centre of the diseased mass consists of a sloughing ulcer with a dirty grayish base. Within twenty-four hours after the appearance of the ulcer, a slough forms and the ulceration continues its extension in all directions. It is very common for the cheek to be perforated and the tissues of the gums destroyed, exposing the bare bone. Even the tongue, lips, palate, eyes and ears may be involved in the general destruction. Hæmorrhage is very unusual, as the bloodvessels are plugged by thrombi previous to separation of the sloughs.

Symptomatology.—The clinical course of gangrenous stomatitis is, in many instances, remarkable for its insidious progress. Very often, indeed, the existence of any local trouble is not even suspected until the destruction is well advanced. Sometimes the first evidence of disease of the mouth is afforded by the gangrenous odor of the breath and saliva. Examination then reveals the blister or the diffuse induration and ulceration above mentioned. Pain, as a rule, is very slight. Indeed, it is ofttimes remarkable to observe the slight discomfort the little patients exhibit in the presence of such a dangerous malady. After the first few days exhaustion becomes a prominent feature. The odor of the breath is truly horrible, pervading the entire house. Fever is present, but the temperature does not usually run very high. The pulse is always weak, becoming rapid and feeble towards the last. The submaxillary glands are but slightly enlarged. Death occurs from exhaustion.

In the few cases which recover, convalescence is tedious, and very disfiguring cicatrices form.

Among the complicating conditions, diarrhœa and broncho-pneumonia are the most prominent. The former probably results from the swallowing of the putrid secretions of the mouth; and broncho-pneu-

monia may result from the aspiration of morbid matter, or as in other asthenic and septic conditions.

Prognosis.—The prognosis in gangrenous stomatitis is highly unfavorable, from seventy-five to ninety per cent. of the cases dying. When recovery does ensue, there is but little tendency to relapse. Cases in which the lesions are confined to the gums offer the best prospects.

MYCOTIC STOMATITIS.

Synonyms.—Thrush; stomatomycosis; soor (German); muguet (French).

Definition.—A disease of the mouth constantly associated with the formation of a fungus now generally regarded as the saccharomyces albicans.

Etiology.—The essential cause of thrush is the formation of this fungus on the mucous membrane of the mouth. Every mouth does not seem to become infected when exposed; so we must look for certain predisposing factors. It is especially liable to attack young infants, although not limited to any particular period of life. It has a marked predilection for the weak and debilitated; many have even claimed that it cannot occur in an otherwise healthy subject, but they are certainly in error. The fungous growth may attack any of the mucous membranes of the body, but is observed most frequently in the mouth and about the vagina. Some authorities have denied the possibility of its invading membranes other than those covered by pavement epithelium, but it has now been conclusively proven that it may affect those with cylindrical epithelium as well. The disease is probably communicated in the majority of cases by infected nipples or nursing bottles. The possibility of infection through the air has been strongly urged with very good reason, for the dry fungus has been found floating about in hospital wards in which the disease was prevalent. Mechanical injury of the mucous membrane of the mouth and catarrhal stomatitis favor infection with this disease.

In adults, thrush occurs most frequently when the patient has been greatly debilitated by some chronic exhausting disease, such as phthisis.

Pathology and Morbid Anatomy.—The nature of the fungus is still debatable. It was first described by Berg, of Stockholm, in 1843. Later, it was again described by Robin, he giving it the name of oidium albicans. Hallier believed it to be identical with the fungus of the acid fermentation of milk, and therefore entitled it oidium lactis. Grawitz's investigations seemed to show that it was the mycoderma vini, a form of fungus associated with the formation of acetic acid out of alcohol. Rees called it the saccharomyces albicans, which is now generally regarded as probably the correct view.

By many the fungus is regarded as of a mixed form. It is undoubt-

edly polymorphic, the different forms in which it appears being dependent upon the media upon which it grows.

The saliva presents an acid reaction, which has led to the claim that the thrush fungus will not grow in an alkaline medium. This is an error, for it has been proven that it will flourish in both neutral and alkaline media; and it is believed by some that the highly acid saliva is the result of the growth.

The fungous growth is made up of filaments and spores. The filaments consist of sharply defined tubules of amber tint, having an average diameter of three or four millimetres. They are branched or simple, according as they are fully developed or not. Within them are numerous elongated cells in compartments, the dividing lines giving the filaments a constricted appearance at these places. The spores consist of spheroid or oval bodies of four to five millimetres in diameter, containing one or two granules and a quantity of fine dust.

The parasite first appears in the form of spores between the epithelial layers of the buccal mucous membrane. Thence it spreads in all directions, sending out its branches. The mucous membrane surrounding the growth is somewhat redder than normal. Suppuration never ensues from thrush alone.

To the naked eye the fungus first appears as small white spots, gradually increasing in size until they form patches, which closely resemble accumulations of curdled milk, but differing in that they are sub-epithelial and cannot be brushed off so readily. They may be discrete or confluent, circumscribed or diffused over the entire mouth. When they are removed, a raw surface is produced, which bleeds on very slight touch. The growth usually occupies the tongue and the mucous surface of the cheeks; exceptionally it may invade the pharynx. Still more rarely it spreads to the œsophagus, where the accumulation of the parasitic growth and swelling of the tissue occasionally proves sufficiently great to result in mechanical obstruction. Its possible invasion of the respiratory tract has been much discussed, and for a long time was decided in the negative. Later investigations, however, show that it may extend even in this direction.

Symptomatology.—The symptoms, aside from those related to the special lesion, are by no means characteristic; indeed, all evidences of ill-health other than those afforded by inspection of the mouth are occasionally absent. In the majority of cases the pain and gastro-intestinal symptoms which accompany so many buccal diseases are present, and as a rule depend for their existence on accompanying catarrhal inflammations. Sometimes the gastric disturbance is the direct result of the swallowing of the fungous growth.

In some cases the detachment of the fungus leaves an ulcer, which may prove very intractable to treatment.

Diarrhœa is not infrequently an associated symptom, and serves to increase the prostration already present, and excite redness about the anus and buttocks because of the irritating character of the stools.

Diagnosis.—Thrush sometimes bears a close resemblance to a deposit of curdled milk on the mucous membrane of the mouth; but the latter condition is readily recognized, for the accumulation can be easily removed by wiping. In the differentiation of thrush and other forms of stomatitis, the microscope affords a certain guide when the ordinary manifestations of the disease are not clearly defined. This is accomplished by placing a portion of the loosened membrane, with a little glycerin, upon a slide, and examining with a medium power objective. If thrush is present the specific organism described under pathology and morbid anatomy of this disease will be observed.

Prognosis.—In nearly all cases of simple thrush, practically in all met in private practice, the prognosis is favorable, the patient recovering within a few days under proper treatment. When complicating exhausting diseases, the outlook is not so encouraging. In hospitals and institutions cases which prove rebellious to treatment are occasionally observed. The younger, and the more debilitated the infant, the greater will be the therapeutic difficulties encountered.

BEDNAR'S APHTHÆ.

Synonym.—Placques pterygoidiennes.

Definition.—A form of superficial ulceration occurring on the palates of very young infants.

Etiology.—Bednar's aphthæ attacks only infants of less than six weeks of age. The previous condition of health seems to exert no influence in its causation, as it may occur in even the most robust. The exciting cause is traumatism, especially the use of a rubber nipple which comes into contact with the affected region, or that resulting from the washing of the child's mouth with undue force. Some authors describe under the name of Bednar's aphthæ a serious form of ulceration attacking the palate in cachectic children, and running an almost invariably fatal course. This latter must be regarded as a very different affection from the benign one under consideration. A slight degree of catarrhal stomatitis is the basis upon which it is frequently developed.

Symptomatology.—Small superficial ulcers are observed on the soft or hard palate to either side of the median line. They are accompanied by redness of the surrounding mucous membrane and some pain.

Prognosis.—The prognosis is nearly always favorable, the ulcerations being dangerous only when they become infected.

TREATMENT OF THE SEVERAL VARIETIES OF STOMATITIS.

There is such a similarity in the treatment of the several forms of stomatitis that the subject will be considered under a single heading.

Much can be accomplished in the direction of prevention of inflammations of the mouth by securing an aseptic condition of all which comes into contact with the mucous membrane of this cavity. Particular attention should be given, if the patient is a child, to the bottle and nipple in use, and the food should of course be free from infective agents. It is necessary to emphasize the necessity of adopting every means to prevent infection, especially in persons who are in deteriorated health.

As traumatism is an important factor in the etiology of stomatitis, nurses are advised to exercise care in the cleansing of the mouths of infants. Much friction even with a soft fabric is objectionable, not to mention direct violence resulting from careless use of the finger. In health it is not necessary to employ antiseptic mouth washes, cleansing the mouth with pure boiled water being sufficient. The same instruction also applies to most cases of stomatitis, but some forms of stomatitis being purely local affections may be controlled by purely local treatment. In troublesome cases a one to two per cent. solution of boric acid frequently gives good results, or borate of sodium in a somewhat stronger solution may be employed. Astringent solutions of tannin, sulphate of zinc, nitrate of silver, etc., are much used, but are not commended except in some unusual cases of torpid ulceration.

It must not be forgotten that whatever may be prescribed as a remedy for stomatitis success will often depend upon the painstaking care with which the details relating to the toilet of the mouth are carried out, and also upon the care which is bestowed upon the digestive organs, skin, etc. After all this has been done some patients must have a change of air before improvement can be secured.

In the treatment of *thrush* many advise employment of mechanical measures for the removal of the fungus, such as gentle friction with a soft cloth, applied with the finger and repeated every few hours. Such removal of the exudate at least permits of the more perfect action of local remedies. Alkaline solutions may be employed, as they soften the superficial accumulation of epithelium and favor its removal. This method appears harmless unless employed with too much force. Cleanliness is the most important feature in the treatment of this form of stomatitis. The mouth should be cleansed with boiled water or some simple alkaline solution, such as the boric acid solution referred to, after each meal. If the patient is at the breast, and the mother's condition is not good, it is important that she should be ordered into the open air and have her diet and exercise regulated.

The *gangrenous form* is very fatal, a few cases only responding to

surgical measures of a radical kind. As soon as the nature of the disease is apparent, unless treatment is manifestly beneficial, the gangrenous area should be thoroughly destroyed by means of the actual cautery, or some one of the most energetic caustics, nitric acid, Vienna paste, bromine and chloride of zinc are most employed. In order to success the action of the agent must be extended to surrounding tissues which appear to be in a healthy condition. Better results would undoubtedly attend this method were it adopted earlier in the course of the disease. The cauterization may have to be repeated several times. The subsequent local treatment consists of antiseptic mouth washes, frequently employed, and the direct application of iodoform, ichthyol, pyoktanin blue, carbolic acid, etc. Personally my results have been best with aristol. These applications are of limited value on account of the difficulty attending retention of the material upon the ulcerating surface long enough to secure its full influence. From results which have followed upon injections of a saturated solution of pyoktanin blue (in water) into gangrenous and carcinomatous tissue, I feel inclined to treat the next case in this manner. Hypodermatic injections of this substance have led to complete destruction and throwing off of such masses, leaving a clean granulating surface, which subsequently healed. The pneumonic condition and gastro-intestinal irritation produced by the aspiration or swallowing of septic matter often determine the fatal issue. Little can be accomplished in the prevention of the entrance of poisonous matters, the most important step being the rendering of the contents of the mouth innocuous.

Potassium chlorate is extensively employed in the treatment of the several varieties of stomatitis. It is especially adapted to the aphthous and ulcerative forms. The free and rapid excretion of this substance by the saliva adds to its value as a local remedy. In the large doses in which it is employed by certain practitioners it is very objectionable, on account of its irritating influence upon the kidneys, sometimes setting up an actual nephritis. The one-tenth trituration gives excellent results, and the local use may be added to its constitutional influence. *Borax* has been long and generally used as a local remedy even by the laity, and exercises an undoubtedly favorable influence. In an attenuated form it was advocated, especially by H. N. Guernsey, when the child exhibits a "fear of falling." Just what the significance of this symptom may be is doubtful, but I have observed favorable action when it was present. *Mercurius* is exquisitely homœopathic to ulcerative stomatitis with its free salivation, puffy indented tongue, offensive breath, etc., and is usually effective in exceedingly small doses. It is less frequently valuable in thrush and other forms of inflammation of the mouth. Before administering mercury it is important to ascertain if this drug has been previously used, as it may be the cause of the stomatitis.

If so, *hepar sulphur* in the third decimal trituration may be considered, and a wash of chlorate of potash advised. *Nitric acid* is in considerable repute for stomatitis with well-developed ulceration, but I have had no success with this remedy in dilutions. A weak aqueous mixture has appeared to be useful, but the result is probably due to its local action. *Muriatic* and *sulphuric acids* are preferred by some. *Argentum nitricum.* Like potassium chlorate, this remedy is valuable in most forms of stomatitis, especially when there is considerable ulceration. While valuable as a local remedy its internal action is decided. It is often useful in adults who are nervous, dyspeptic, flatulent, and who perhaps suffer from gastric catarrh. It should be used only in fresh triturations or dilutions, small doses of the second decimal being preferable. *Baptisia* has proven serviceable in mercurial stomatitis, and that form occurring in nursing women. I have used it with satisfaction when the stomatitis was associated with chronic exhausting disease, *e. g.*, pulmonary phthisis, Bright's disease, etc. The more offensive the breath, the greater the evidence of a deteriorated mucous membrane, whether associated with the mouth or the stomach and bowels, the more likely is baptisia to prove useful. *Arum triph.* is useful in general acute catarrhal stomatitis when the mucous membrane is red, hot, and there are much pain and sensitiveness. The discharge may be of an irritating character. The third to the sixth decimal dilutions may be employed. *Belladonna* may benefit similar cases if the mouth and throat are dry and there is an absence of excoriating discharges. *Aconite* or *gelsemium* sometimes helps cases of this character if the hyperæmia is very marked and there is considerable fever. Their favorable action is usually, however, of short duration, as the element of hyperæmia quickly diminishes or the lesion increases, calling for another medicine. *Sulphur* has afforded me much assistance in some obstinate cases of stomatitis, when there were vaso-motor irritability (flushes), gastro-intestinal disturbance with diarrhœa, redness of the skin caused by irritating stools, etc. The third to the sixth triturations may be given every two or three hours.

DISEASES OF THE TONGUE.

SIGNIFICANCE OF THE TONGUE IN DISEASE.

From time immemorial the condition of the tongue has been regarded as affording valuable information in the investigation of disease, an inspection of this organ being considered a necessary part of nearly all medical examinations. It is true that inspection of the tongue does afford most valuable information, but the importance of this procedure in certain directions has been overrated, while valuable information afforded by it in others has been entirely ignored. Too often the examination of the tongue is performed with assumed wisdom concealing or exposing the examiner's ignorance.

Observations of the tongue should be directed to the discovery of the size, shape, degree of moisture or dryness, the smoothness of the surface, the color, coating, mobility, and the sensibility of the organ.

Size.—Local conditions of an inflammatory character often produce an enlargement of the tongue. This condition is also observed as a symptom of disease elsewhere, *e. g.*, in heart diseases, when there is interference with the return flow of blood from the head, leading to vascular engorgements of all the tributary vessels. A large tongue is commonly observed in idiots and imbeciles. In nervous diseases, notably hemiplegia, general paralysis of the insane and disseminated sclerosis, it is often large and flabby, sufficiently so at times to interfere with its movements or the proper closure of the mouth. The tongue is enlarged in quite a variety of adynamic diseases, particularly typhus and scurvy, and in hepatic disorders and anæmia. In the last two named it takes the imprints of the teeth.

Decrease in the size of the tongue is observed at times in certain acute infections, as typhoid fever (when it must be regarded as an unfavorable sign), and as a part of a general or local muscular atrophy.

Shape of the Tongue.—The shape of the tongue is often an evidence of local conditions. Circumscribed swelling with induration is usually the first manifestation of malignant disease. Indentations of the edges of the organ by the teeth are suggestive of enlargement not discernible otherwise. In various forms of paralysis the shape of one side of the tongue is altered either by reason of atrophy of the lingual muscles or because of diminished motility. Very often a persistent dryness of the mouth influences the shape of the organ, rendering it more

concave than normal. This latter phenomenon is due to dryness of the upper epithelial layer. In certain fevers the tongue becomes narrow, a change explained by Gubler as resulting from contraction of the transverse muscular fibres.

Unilateral atrophy of the tongue has been observed as an early symptom of locomotor ataxia.

Degree of Moisture.—In the degree of moisture of the tongue we have a very valuable prognostic guide. With a dry tongue becoming moist, we have an assurance of a favorable future. Dryness of the tongue is observed in all conditions forcing the patient to breathe with open mouth, as in nasal obstruction, pulmonary and heart diseases febrile conditions, and acute inflammation of the abdominal viscera. It is one of the phenomena of belladonna poisoning, and is observed in health as a result of nervous excitement, prolonged talking, and in smokers. In adynamic states with dry tongue, the epithelial layer of the organ becomes horny and soon cracks. Such a condition must always be looked upon as unfavorable. The reappearance of moisture indicates surely that the vital forces are regaining their wonted strength.

Surface of the Tongue.—Normally, the tongue presents a convex upper surface slightly roughened by its papillæ. It may be altered by disease, either by local or general conditions. Among the former may be mentioned various eruptions, and as evidence of disorder elsewhere, the cracks and fissures of gastric disease. It must be remembered, however, that a cracked or fissured tongue is normal to quite a number of people. When abnormally dry, the surface of the tongue may present a glazed appearance from the presence of inspissated mucus.

Color of the Tongue.—The color of the tongue is in a great measure influenced by the condition of the blood. In anæmia it is observed to participate in the general pallor; in deficient aeration, as in cardiac disease and obstructive lesions of the upper air passage, it is cyanotic. In fevers, it is often abnormally red. In scarlatina, it is unusually red, with enlargement of the papillæ, a condition generally known as "strawberry tongue." In diseases characterized by widespread staining of the skin, viz., jaundice and Addison's disease, the condition of the tongue often corresponds. In conditions of chronic debility the tongue is often unduly red and moist. An extremely red and dry tongue is a frequent accompaniment of gastro-intestinal inflammations. Alimentary and medicinal substances often stain the tongue. It is said that tea-tasters often show a yellowish, orange-tinted coating upon the tongue; tobacco chewers present the yellowish discoloration peculiar to the weed.

Movements of the Tongue.—The manner in which the tongue is protruded is often suggestive. The hysterical person responds to the request to protrude the organ almost as if the act afforded her a pleas-

ure. In the so-called typhoid state the sluggish mental state makes the patient tardy in his response to a request to protrude the tongue. Excessive dryness of the organ is often so great as to interfere seriously with its movements. In hemiplegia, the tongue, when protruded, deviates towards the side on which the lingual muscles are paralyzed. Tremor of the tongue is common in the adynamic fevers, and is a pretty constant phenomenon of certain nervous diseases, as general paralysis of the insane, chronic alcoholism, neurasthenia, and lead poisoning. In progressive muscular atrophy the fibrillary twitchings so frequently observed in the wasting muscles, also affect the muscles of the tongue.

Spasms and paralysis of the tongue have already been referred to in the section on nervous diseases in Volume I.

Coating of the Tongue.—Probably the best classification of coatings of the tongue is that of Dickinson, who divides them into the stippled, coated, plastered, furred or shaggy, incrusted, and denuded.

The *stippled* tongue is one in which the coating is thin and covers the tops of the papillæ only, the intervening depressions being clear.

The *coated* tongue presents a deposit which is continuous over the greater portion of the dorsum of that organ.

The *plastered* tongue is so-called because the coating covers the entire dorsum with the exception of the edges and a small space at the tip, and is spread on so thickly and evenly as to suggest the laying on of plaster.

The *furred or shaggy* tongue is produced by the lengthening of the papillæ and the deposit of adventitious matter upon and between them.

The *dry incrusted* tongue is explained by the name; the tongue is covered with a dry crust effectually concealing the papillæ; it is a late stage of the shaggy tongue. The incrustation is often broken by regular or irregular fissures.

The *denuded* tongue is produced by the casting off of the incrustations, leaving a mucous membrane denuded of its epithelium.

The substance which goes to make up the coating of the tongue has been shown by Dickinson's investigations to be composed mainly of epithelial accumulation, and in less degree of micro-organisms. Some observers have inclined to the view that it is composed mainly of the latter.

The different degrees of coating must be regarded as different shades of intensity of the same process. The extent and depth of the deposit is influenced by the degree of pyrexia, the movements of the tongue, the duration of the disease, and the relative degree of moisture and dryness.

The *stippled tongue* is very common in health. It is observed with especial frequency among smokers. The coating is limited almost entirely to the dorsum of the tongue, the edges and tip being free, owing to friction with the teeth, palate or gums. When present in diseased conditions it is as a rule significant of a mild illness. Pyrexia is rarely high; prostration or a low state of vitality is commonly absent.

The next gradation of coating is the *stippled plus a "coated" tongue.* Microscopic examination shows an elongation of the papillary processes and increase of the deep epithelium of the tongue. This condition is observed in chronic diseased states, and in acute diseases, especially with a somewhat more pronounced pyrexia than is observed associated with the stippled tongue.

The *coated tongue* may be observed in any acute or chronic disease, but especially in acute affections associated with a marked pyrexia. The coating is generally the thickest on those parts of the organ subjected to the least friction. The color of the coating is modified by a variety of circumstances. It is whiter according as the illness is more acute. As disease continues, it assumes a brownish hue. Dryness of the parts exerts a similar influence on the color. The color may be influenced by other circumstances already detailed. The coated tongue is attendant upon a higher degree of constitutional disturbance than any of the preceding varieties; pyrexia is higher, and prostration greater.

The *strawberry tongue* is generally associated in the professional mind with scarlet fever; but it may be found in other acute febrile disorders, as pneumonia, typhoid fever, and appendicitis.

The *plastered tongue* is called by Dickinson the coated tongue of acute disease. The uncoated portions of the tongue are as a rule redder than normal. The more recent the onset of the disease the whiter is the covering. The plastered tongue depends largely on lengthening of the papillæ of the tongue and epithelial deposit. The accumulation is dependent upon non-use of the tongue, and overproduction of epithelium by febrile action. This form of tongue is often accompanied by lessened secretion of saliva, the mouth becoming drier as the coating thickens.

The *furred and shaggy tongue* is the result of disuse and want of moisture.

The coated tongue in its various shades of intensity is a common condition in gastric disorders, but it is so frequently absent as to possess comparatively small diagnostic value. In constipation the same is true. In acute constipation, in which case constitutional disturbance is profound, the tongue is heavily coated; while in chronic cases, a clean tongue is not infrequently observed.

Mapped Tongue.—This condition, also known as geographical tongue, ringworm of the tongue, and exfoliative marginate glossitis, consists of the development of circinate patches on the tongue, which exhibit a tendency to wander from one portion of the organ to another. They are observed very frequently in children, but are by no means confined to the young. They are frequently associated with gastro-intestinal disturbances; sometimes they occur without any other subjective or objective evidence of disease. They have been observed to persist

after the condition apparently giving rise to them has disappeared. Usually no local discomfort is produced; occasionally, they are accompanied by slight itching and salivation. Some regard the trouble as of parasitic origin, but this may well be doubted. Pepper considers it a tropho-neurosis. It is a very obstinate affection, and shows a remarkable tendency to recurrence.

Black Tongue.—This condition is also spoken of as parasitic glossitis, although it is now quite generally acknowledged that it is not of parasitic origin. Other synonyms are *nigrities* and *glossophytia.* It is not often observed, but most frequently with neurotic and dyspeptic disturbances. The papillæ of the tongue become greatly elongated so as to resemble hairs and at the same time are pigmented a dark brown or black.

GLOSSITIS.

Definition.—Inflammation of the tongue.

Glossitis may be either acute or chronic; according to the portion of the organ involved, it is designated as *parenchymatous* or *superficial,* and according to its distribution, *circumscribed* or *hemi-glossitis.* A form of inflammation of the tongue has been described, characterized by the development of a number of deep fissures or indentations over the surface of the organ, under the name of *glossitis dessicans.* Its exact etiology is unknown. It seems to be but a severe variety of superficial glossitis, and in a considerable proportion of cases occurs in connection with the syphilitic constitution. It is not a serious disorder, but is often intractable.

Etiology.—A mild form of superficial glossitis is sometimes associated with the ordinary inflammations of the mouth, pharynx or tonsils. It also seems to be symptomatic at times of chronic gastro-intestinal inflammation, especially when the latter has arisen from long-continued alcoholic excesses.

The position of the tongue favors frequent traumatism, and yet the tolerance of the organ is such that inflammation very rarely results from this cause. It occasionally happens that foreign substances taken with food, as fishbones and sharp pieces of solder, produce a severe inflammatory reaction. Carious teeth presenting sharp and ragged edges, by constant friction excite a glossitis which, though usually superficial, may under unfavorable circumstances become parenchymatous.

The inhalation of hot tobacco fumes is very apt to excite an acute superficial glossitis.

Poisonous wounds, as the stings of insects accidentally taken into the mouth with the food, and anthrax infection, have accounted for some severe cases of the parenchymatous variety.

Certain poisons, notably those exerting a highly irritating local

action, as ammonia, potash, soda, the various acids, etc., when taken into the mouth undiluted, almost certainly set up a parenchymatous glossitis of high grade.

The development of glossitis is greatly favored by the existence of conditions depreciating the general system, as anæmia, gout, erysipelas, syphilis and tuberculosis.

The poisons of the specific infectious diseases may excite it, particularly that of scarlatina.

Chronic mercurial poisoning produces superficial glossitis (in former years more than at present).

Pathology and Morbid Anatomy.—It would appear that a severe attack of diffuse parenchymatous glossitis occurs from traumatism only in the presence of some infecting agent, or of constitutional depreciation. It has been claimed that some cases are due to the same agencies that give rise to mouth and foot disease. In all varieties of lingual inflammation there is an increase in the epithelial deposit, which may or may not form a crust, which is soon cast off, exposing a bright red surface with prominent papillæ.

In the parenchymatous variety there is rapid infiltration of the connective tissue of the organ, and this at times leads to degeneration of the muscular fibres. In the majority of cases the subsidence of inflammation is followed by a return of the parts to their normal condition; in others, there remains more or less enlargement. In some few instances suppuration, and still more rarely, gangrene ensue.

Symptomatology.—Acute superficial glossitis is rarely attended by other than local symptoms, these consisting of slight stiffness and dryness of the tongue, and more or less pain when the organ is moved, as in deglutition.

Pain is a prominent symptom in the chronic superficial variety, and is especially manifested during eating. Very slight traumatism and association with dyspepsia tend to the production of fissures.

Acute parenchymatous glossitis is fortunately a rare disease. The inflammation is of rapid onset. The tongue becomes enormously swollen. The first symptom is pain in the tongue, resulting in interference with its movements. In very many instances the changes are first observed at the base of the tongue, and this is especially apt to be the case when the inflammation has arisen from cold or by extension from the tonsils. Constitutional symptoms, such as rigors, pyrexia and widely distributed pains, are by no means uncommon. The tongue after a few hours becomes dry and the swelling rapidly increases in extent until finally its functions are seriously interfered with. The enlargement of the tongue may be so great that the mouth cannot be closed and a portion of the organ projects from between the teeth. Pressure is exerted on the soft palate and upon the epiglottis, greatly impeding respiration.

The sublingual glands are enlarged; the breath is offensive, often horribly so. The advent of suppuration is characterized by the severity of the symptoms and the usual local evidences of this process.

The pain throughout is very severe. The onset of gangrene is marked by constitutional disturbance, especially great prostration.

Diagnosis.—Acute parenchymatous glossitis cannot be confounded with any other disorder. A circumscribed suppuration may be mistaken for cystic tumor, but the history of the case should remove any doubt; aspiration of the tumor effectually decides as to the nature of the contained fluid.

Prognosis.—Acute superficial glossitis offers a very favorable prognosis. Acute parenchymatous glossitis is a very serious disorder. Resolution may take place in from two to six or seven days. Severe cases may terminate fatally in about a week. When suppuration complicates the case, it generally makes its appearance in about a week. Such cases always pursue a prolonged course. Gangrene is rare and a very dangerous complication. In cases progressing to recovery, it may lead to more or less extensive deformity of the tongue.

Treatment.—Acute superficial glossitis requires attention to cleanliness of the mouth. The administration of small pieces of ice is usually grateful to the patient, and aids in subduing the inflammation.

Acute parenchymatous glossitis requires more active measures in addition to the above. Longitudinal incisions on either side of the median line of the tongue may be demanded even before the advent of suppuration, and tracheotomy may be required if this does not relieve, also in cases with extension of the process to the larynx and the development of œdema. The food should be of liquid character and as nourishing as possible.

The medicines suitable to glossitis are much the same as are recommended for tonsillitis. In the beginning when there are heat, dryness, redness and headache, *belladonna* may prove sufficient. If the attack begins with a chill and marked febrile symptoms, *aconite* is preferable for a short time. If these remedies do not arrest the progress of the inflammatory process, *mercurius* had better be administered, particularly if the tongue is greatly swollen, covered with a slimy coating and there is copious salivation, and suppuration is imminent. Added to these conditions there may be disorder of the gastro-intestinal tract and marked prostration. If a favorable action does not result from this selection, *lachesis* may be chosen if there is much sensitiveness of the inflamed parts, associated with the delirium, aggravations and general symptoms of this medicine. *Rhus toxicodendron* has helped cases attended by a great deal of stiffness of the parts in the early stage, also when excited by the poison of erysipelas or other infectious diseases. *Cantharis* has been recommended for glossitis due to burns and scalds. I have no experience with

it, and think the suggestion theoretical. *Apis*, unaided, proved successful in a remarkable degree in a case supervening upon scarlatina. The tongue protruded, with inability to close the mouth. The prominence of œdema led to its selection. Judging from its action in phlegmonous tonsillitis *hepar sulphur* should prove a remedy of first importance in typical phlegmonous glossitis. I have not had opportunity to test it fully. For imperfect resolution *iodide of potassium*, *biniodide of mercury*, *chloride of gold*, and *sulphur* should be considered.

The superficial forms of glossitis demand that an investigation should be made into the general health, with disturbance of which they are usually associated, being most frequently related to digestive disorders and syphilis. Any cause of local irritation, such as bad teeth or ill-fitting plates, should be removed. Rough food must be avoided. Stimulating food, especially condiments, are not permissible, nor are alcoholics. Mouth-washes of plain water frequently used, or solutions of *boric acid* or diluted *listerine* should be regularly employed. The fissures may be pencilled with solutions of *ichthyol*, with a one per cent. solution of *hydrochlorate of hydrastinine*, or, in obstinate cases, with *nitrate of silver*. The use of the latter agent should be preceded by cocaine, and is of decided value if there is much pain and inability to masticate food. Internal medicines must be selected largely according to the underlying complaint. *Arsenic*, *hydrastis*, *rhus tox*, *nux vom.*, and *argentum nitricum* are valuable.

Iodide of potassium, *iodide of mercury*, and *chloride of gold* are suitable to syphilitic cases.

MACROGLOSSIA.

Definition.—An idiopathic hypertrophy of the tongue.

Etiology.—Macroglossia is a congenital affection in the majority of cases, although the trouble is not always very pronounced at the time of birth. The increase in size of the tongue is commonly very rapid during infantile life, probably because of the local irritation and hyperæmia excited by the act of nursing. Some cases are associated with idiocy.

Pathology and Morbid Anatomy.—In many cases all the structures of the tongue participate in the hypertrophy; in the majority, however, the muscular tissue only is involved. Usually the enlargement affects both sides of the tongue alike.

Symptomatology.—The essential symptom of macroglossia is enlargement of the tongue. This may at times exist to a remarkable degree, even being so great that the organ cannot be contained within the mouth. When the base of the tongue is much involved, respiration is greatly impeded. In instances in which the enlargement is sufficiently great to prevent closure of the mouth, the saliva dribbles and the portion of the tongue protruded from between the teeth is very liable to become

hard, dry and fissured. Mastication and deglutition are of course greatly interfered with. The lower jaw not infrequently undergoes changes in shape owing to the pressure exerted by the tongue.

Diagnosis.—Macroglossia can only be confounded with the enlarged tongue of chronic parenchymatous glossitis. The occurrence of the former condition in children and the history of the case should prove an all-sufficient means of differentiation.

Prognosis.—The prognosis is favorable under surgical treatment.

Treatment.—Mechanical measures designed to reduce the size of the tongue by compression have been tried, but have proven of little avail while acting as causes of local irritation. When the enlargement is so great as to interfere with deglutition, it may be necessary to use liquid food, which should be passed well back into the mouth through a tube, or be introduced *via* a soft rubber catheter passed into the pharynx and œsophagus through the nose. Whenever the deformity becomes so great as to interfere with local functions, surgical treatment should be resorted to. Remedies which offer some prospect of benefiting these cases are *aurum et sodii mur.*, *conium*, *arnica*, *rhus toxicodendron*, *iodine* and *iodide of potassium.*

AFFECTIONS OF THE SALIVARY GLANDS.

METASTATIC PAROTITIS.

Synonym.—Symptomatic parotitis.

Etiology.—Inflammation of the parotid gland occurring as an idiopathic epidemic disease has already been described in the article on mumps (see Vol. I, p. 303). It now remains to describe parotitis as it appears under other circumstances than as an infectious disorder. Thus it may arise as the result of local causes, these including traumatisms in great variety, obstruction of the salivary ducts, as by calculi, swelling of the mucous membrane, and extension of inflammation from neighboring structures. Taking cold has been assigned as a cause, but seems to be a very rare one. Cases of a more malignant character proceeding as a rule to suppuration appear during the course of certain acute diseases, notably, however, in the course of scarlatina, typhus and typhoid fevers, and pneumonia. The explanation given for the occurrence of parotitis as a complication of these febrile affections is that the pyrexia produces a drying up of the secretions of the mouth, leading to obstructed outflow, decomposition of the saliva and local infection. Another theory provides for transmission of infective matter along the course of the salivary ducts from the mouth; some say infection occurs by way of the blood. Cases have appeared as complications, succeeding ovariotomy and other abdominal operations and diseases.

Symptomatology.—The general character of the symptoms differs in but few particulars from that observed in idiopathic parotitis. The inflamed gland is apt to be harder than in the idiopathic disorder. The tendency of the disease is to progress steadily to suppuration, the overlying skin then being of a blue-red color. In some cases local gangrene occurs.

Diagnosis.—The only chance for diagnostic error is in the possibility of confounding parotitis with inflamed cervical lymphatics. The situations of the swellings in the two cases are, however, sufficiently separated to prevent mistake in the presence of proper anatomical knowledge.

Prognosis.—Metastatic parotitis is a serious complication, especially so when it occurs early in the course of the primary infectious disease to which it is secondary. Appearing during convalescence, it generally follows a favorable course. It may leave an unsightly deformity in front

of the ear. In some cases hearing is destroyed by extension of the suppurative process to the ear; and in still others, a permanent facial paralysis results, because of involvement of the facial nerve in the pathological process.

Treatment.—The local treatment consists of careful attention to the cleanliness of the mouth, the application of ice-bags to the inflamed gland, and liquid diet. Internally, the remedies adapted to local inflammations, suppurative processes, and pyæmia, are indicated. These include *belladonna, mercurius, hepar, silicea, arsenic, lachesis, rhus* and *iodine*, according to indications.

SALIVATION.

Synonyms.—Ptyalism ; sialorrhœa.

Definition.—Salivation is an increased flow of saliva.

Etiology.—The normal quantity of saliva has been placed at from two to three pints in the twenty-four hours. In cases of salivation this may be increased to as much as eight pints. In the majority of cases the flow does not reach more than two quarts. The causes producing this condition are quite varied. Probably the most commonly observed is the excessive use of mercury. The increased flow in such cases is probably the result of the local action of the drug, for it has been observed that mercury is eliminated freely by way of the saliva. Mercurial salivation is, in the majority of instances, associated with some degree of stomatitis. This has led to the suggestion that the ptyalism is secondary to the buccal disorder, a conclusion that cannot be correct, because cases of ptyalism from mercury in which not the slightest vestige of stomatitis or other buccal disorders was visible, have been observed repeatedly. The quantity of mercury required to produce salivation varies according to the idiosyncrasies of the individual. Examples in which as small a dose as one grain of calomel or a single vaginal douche of mercuric chloride have brought on salivation, have been recorded. On the other hand, we may see patients in whom the administration of large doses of mercurial preparations carried on for a long time are without visible local effect on the mouth or the salivary glands. Increased susceptibility to mercury is sometimes inherent in the individual, and sometimes it is due to lack of cleanliness. Salivation and stomatitis from mercury are very unlikely to appear in persons who are exceedingly careful about keeping their teeth thoroughly clean. That these symptoms are due in many instances to the local effects of the mercury is confirmed by the fact that they are especially liable to appear when the form of administration is such as to bring the crude drug in direct contact with the buccal mucous membrane, as in the administration of calomel powders, and by the fact that the first morbid signs are observed in parts to which the mercury-laden saliva gravitates.

Salivation is also liable to be the more marked when the drug poisoning is induced rapidly.

Salivation is a symptom of most disorders of the mouth. Thus it is found in the various forms of stomatitis, in parotitis, and in diseases of the gums. It sometimes occurs as a critical flux in some of the infectious disorders, but such cases are exceedingly rare. It may arise from local irritation produced by a carious tooth. It has been observed in conjunction with gastric conditions, as nausea, gastric catarrh and intestinal worms.

In some cases it accompanies diseases of the genital organs. Instances in which it was associated with nymphomania have been recorded. Ptyalism not uncommonly occurs in association with pregnancy. It usually makes its appearance at about the sixth week of pregnancy, or about the same time the vomiting appears. It is generally associated with the latter condition in marked degree, and tends to disappear at from the third to the fifth month. Sometimes it continues until parturition, and has even been observed to last beyond that period.

Salivation is observed also in the course of quite a variety of nervous affections. In many of these there is an actual increase of salivary flow, while in others the dribbling of saliva seems to be dependent upon the paretic condition of the muscles of the tongue and lips. It is not uncommonly observed among the insane and as an accompaniment of facial neuralgia.

Other drugs than mercury can produce salivation, notably the gold salts, silver, iodine, copper, arsenic, lead, and pilocarpine.

Symptomatology.—In mercurial cases the first symptom is usually a slight tenderness of the teeth associated with a metallic taste in the mouth. The gums appear reddened or swollen, and pressure thereon causes the escape of a small amount of pus from between their edges and the teeth. They soon begin to recede from the teeth, which feel to the patient as if elongated. The flow of saliva becomes abnormally great and dribbles from the mouth. This completes the clinical picture of the ordinary case. In some instances the trouble proceeds still further. Ulceration of the buccal mucous membrane appears, and the breath becomes horribly fœtid. The gums become spongy and bleed in response to slight manipulation. The teeth may loosen and even drop out. Gangrene may develop, even gangrenous inflammation of the salivary and neighboring lymphatic glands.

In salivation from reflex irritation, the increased salivary flow constitutes, in most instances, the only symptom. Sometimes the flow is so large as to result in a serious drain on the system, producing marked prostration and even death. It is very apt to act mechanically, to interfere with conversation and eating. The involuntary escape of

saliva from the mouth may produce an erythema of the parts over which it flows. It is very exceptional for the ptyalism arising from reflex causes to give rise to changes in the structures in the mouth.

Prognosis.—This is favorable as a rule, the symptoms disappearing promptly on the removal of the cause. Exceptionally, mercurial salivation persists long after the abandonment of the drug, and gives rise to considerable trouble. The associated stomatitis is sometimes slow in disappearing, the mouth remaining tender for a long time. Well-developed cases of ptyalism of pregnancy resist all treatment. Mild cases disappear spontaneously at about the third month.

Treatment.—The treatment of ptyalism will vary according to the cause. Mercurial cases require the enforcement of cleanliness of the teeth and mouth, and the administration of bland, easily digested and nutritious food. Iodide of potassium has been recommended as an antidote. While this medicine most undoubtedly favors the elimination of mercury from the system, it must also be remembered that its exhibition is liable to be followed by an aggravation of mercurial phenomena because of the quantity of mercury in the system rendered soluble by it. We find better remedies, as a rule, in *hepar* and *iodine*. The latter may be used locally as well, in the form of a mouth-wash—a few drops of iodine being mixed with a glass of water for that purpose. Permanganate of potash solution, peroxide of hydrogen, and listerine, may also prove valuable.

For the salivation of pregnancy the old school recommend atropine, which we believe to be nearly valueless even as a palliative, notwithstanding its physiological antagonism to ptyalism. Other remedies do not offer much better prospects in the severe cases. When there are marked nausea and vomiting, the bismuth preparations are of some avail. *Jaborandi* helps some cases. *Helonias* is indicated and of value occasionally. The literature bearing on the subject is meagre, and individual experience is limited, making it impossible to speak authoritatively.

In a very chronic, obstinate case, occurring in an elderly woman without apparent cause, Dr. W. D. Bayley effected a prompt cure with subnitrate of bismuth 1x. Slight returns have been promptly checked by the same treatment.

Some of the best results I have witnessed have resulted from *cuprum sulph.* in the lower triturations.

Consult also *euphorbium*, *nitric acid*, *pulsatilla* and *sulphur*.

As a palliative, gum-chewing will prove a great comfort to some patients, probably by improving the quality of the saliva through stimulation of the salivary glands and thereby enabling it to be swallowed.

XEROSTOMIA.

Synonyms.—Dry mouth; ptyalism.

This condition is very rare, but few cases having been recorded in literature. Its causes are entirely unknown, all suggestions relating to its etiology being largely conjectural. The symptom is dry mouth, which gives rise to difficulty in mastication and deglutition. In a case treated by Dr. Bartlett, Steno's ducts had all but closed. They were accordingly opened freely with a Bowman canaliculus knife, with some apparent improvement, but which was soon shown to be illusory. The secretory trouble was undoubtedly primary, the ducts becoming narrow from lack of use. In this case the tongue was red, dry and cracked. All medicinal and hygienic treatment failed to cure.

ANGINA LUDOVICI.

Synonyms.—Cellulitis of the neck; phlegmonous inflammation of the floor of the mouth; cynanche cellularis maligna; pseudo-erysipelas subtendinosum colli.

This affection appears to be of rare occurrence in recent times, though not uncommon during the early decades of the present century. Its true nature seems to be obscure. Some attribute it to metastatic inflammation starting in the submaxillary salivary glands, just as does a similar inflammation involve the parotids. In many cases, however, the clinical histories furnish no particulars corroborative of such a theory. Cold, typhus fever, the exanthemata, and scurvy, have been assigned as causes.

Symptoms.—The swelling begins in the neck beneath the chin, and is soon associated with typhoid symptoms, showing the adynamic character of the affection. The inflamed area becomes greatly indurated, and extends, until it may reach to the sternum. Deglutition becomes impossible; œdema of the larynx and trachea may occur as complications. The floor of the mouth is pushed upward by the swelling, adding to the patient's sufferings and increasing the mechanical difficulty of swallowing.

Prognosis.—The disease is a serious one, many cases dying. Those that recover do so only after a long illness. Sometimes the inflammation does not go on to suppuration, resolution taking place. In such cases the inflammatory infiltration is slow in disappearing. In other cases suppuration or gangrene set in. Death usually results from gangrene.

Treatment.—The treatment of this disease consists of the administration of highly nourishing liquid food, and the exhibition of remedies adapted to such an asthenic condition.

There is but little reported experience. Hughes mentions Schweickert's successful use of *anthracine* in several cases, and his own favorable results with *bryonia* and *helpar sulphuris*. Isolated experiences suggest *rhus, lachesis, crotalus, silica.*

AFFECTIONS OF THE TONSILS.

ACUTE CATARRHAL TONSILLITIS.

Definition.—An acute inflammation involving the mucous membrane covering the tonsils.

Etiology.—Catarrhal tonsillitis usually results from exposure to cold. Local changes in these glands, as chronic hypertrophy and retained concretions, sometimes act as predisposing causes through the irritation they occasion.

Symptomatology.—The disease is ushered in by very mild constitutional symptoms and soreness of the throat. Examination shows increased redness and slight swelling of the mucous membrane covering the tonsils. The lymphatic glands of the neck are slightly, if at all, involved.

Prognosis.—This is invariably favorable, recovery ensuing in the course of three or four days.

Treatment.—If the symptoms are quite acute the patient should remain indoors in an equable temperature until well.

Guaiacum is specific to the various catarrhal forms of inflammation of the throat. The tincture on disks is the preferable mode of administration.

Occasionally *belladonna, mercurius* or *hepar* may be administered according to the associated symptoms.

ACUTE SUPPURATIVE TONSILLITIS.

Synonyms.—Quinsy; amygdalitis; phlegmonous sore throat; angina tonsillaris.

Definition.—An inflammation involving the parenchyma of the tonsils.

Etiology.—Diathesis and age are important predisposing causes of parenchymatous tonsillitis. The disease is especially liable to occur and recur in subjects of strumous constitutions, and it has been observed with especial frequency, to bear some relation to acute inflammatory rheumatism. Some authorities make the claim that tonsillitic patients can give some kind of a rheumatic history in about 70 per cent. of all cases. When bearing a direct relation to rheumatism tonsillitis may either precede or follow that disease. As regards age, it attacks patients

from the fifteenth to the thirtieth years, the age of twenty-five being the one of greatest predisposition. It is rarely encountered prior to the age of puberty or after the beginning of middle life. Males are affected with greater frequency than females. The existence of chronically enlarged tonsils undoubtedly predisposes to acute inflammation of these glands.

Among the exciting causes exposure to cold and damp and acute infections stand foremost. Tonsillitis is a frequent condition during the course of scarlatina, measles and variola. Cases arising from septic causes are always bilateral. Other cases are usually unilateral; if bilateral the appearance of the inflammation in both glands is not simultaneous. Mechanical causes account for some cases; among these may be enumerated the inhalation of irritating gases and the swallowing of foreign bodies. Septic causes occasionally originate in exposure to sewer gas and the drinking of impure water. In the majority of cases both predisposing and exciting causes are necessary, for some persons exhibit as great susceptibility as do others immunity.

Pathology and Morbid Anatomy.—The various elaborate pathological divisions of tonsillitis are unnecessary. The deep, or parenchymatous form, and the superficial representing all we recognize clinically. The morbid changes are those incident to inflammation of the glandular structure of the tonsils. The inflamed tissue becomes enormously swollen and the anterior and posterior palatine folds are put on the stretch. The inflammation frequently spreads to contiguous structures, as the palate and pharynx. Sometimes neighboring tissues become œdematous. The suppuration occurs in the connective tissue surrounding the tonsil and the abscess may point about the free surface of the gland. The exciting cause of the inflammatory process is probably a microorganism.

Symptomatology.—Acute parenchymatous tonsillitis is usually ushered in by pronounced general symptoms. There may be a chill, but much more frequently simple chilliness. This is followed by fever, the temperature varying from 102° or 103° F. to 105° F. There is headache, backache, and soreness of the body generally. Almost at once pain in the throat is experienced, which is greatly aggravated during deglutition. Inspection shows one of the tonsils to be more or less swollen, and in extreme cases it may reach laterally beyond the median line, filling the throat and seriously interfering with swallowing, even of saliva. The mucous membrane covering the tonsil is of a bright or livid red, a color also assumed by the membrane covering the neighboring soft parts. The crypts of the tonsil are soon filled with broken-down epithelium, mucus and pus. The pain, which at first amounted to a mere soreness, increases until it becomes of great severity. The hearing is sometimes dulled owing to the extension of the inflam-

mation to the orifice of the Eustachian tube, and during efforts at deglutition pains may shoot into the ears. The enlargement of the tonsils in nearly all cases leads to changes in the quality of the voice, and occasionally to embarrassed respiration. The lymphatics about the lower jaw are usually more or less enlarged.

Diagnosis.—It would seem almost impossible to mistake parenchymatous tonsillitis for any other affection. But like other acute throat diseases it is sometimes confounded with diphtheria, from which affection it may be readily differentiated by the characteristics of the diphtheritic membrane. A pardonable error is that which overlooks a scarlatina with slight cutaneous symptoms and marked tonsillitis. In this disease, however, both tonsils are simultaneously affected, and the strawberry tongue is a prominent symptom, both of which features are lacking in parenchymatous tonsillitis.

Prognosis.—Acute parnechymatous tonsillitis usually undergoes resolution in four or five days. Many cases, however, proceed to suppuration, when the course may be prolonged to ten days or two weeks. The termination in practically all cases is recovery, though a fatal issue sometimes results from the escape of pus into the larynx upon rupture of the abscess, also from œdema of the larynx, hæmorrhage from opening of a large artery, or from exhaustion in those already debilitated by previous illness. In scrofulous subjects chronic hypertrophy of the tonsils not infrequently follows.

Treatment.—The patient should remain in bed or at rest in his room. Many cannot lie down without much distress and are therefore better with their clothing on. Some relief is gained from inhalations of steam, also from cold or hot applications to the neck. Sipping cold or hot water may also afford some comfort. In the early stage a few doses of *aconite* may be of service if fever is a marked symptom and the patient restless and presenting other aconite symptoms. But this remedy cannot be long relied upon, as it is not adapted to the fully developed inflammatory process. Some advise *belladonna*, especially if the parts are very red and dry and there is much headache, etc., but I have learned to have little confidence in it for tonsillitis of the suppurative type. Incomparably superior is *hepar sulphur*, which should be given as soon as the true nature of the case is apparent. The second or third decimal trituration, frequently repeated, constitutes the best method of administration. The use of this medicine frequently prevents suppuration. Hughes and others rely upon *baryta carbonica* for the same purpose, but I have not found it as reliable as hepar. *Baryta iodide* in the second decimal trituration has given better results than the carbonate. There is seldom need of other medicines, although occasional cases may call for *lachesis, lycopodium* or *rhus tox.*

As soon as evidences of a purulent accumulation are present it is

wise to puncture the abscess. If done skillfully it is attended by no risk and affords great relief to the patient, often lessening the period of suffering one or two days. It is best accomplished with a sharp pointed bistoury, wrapped to within one-half inch of the point with adhesive plaster.

To prevent recurrences the cause should be discovered, if possible, and removed. If the tonsils are enlarged and do not yield to *biniodide of mercury, baryta iodide, hepar sulphur, calcarea carbonica, sulphur*, etc., they should be reduced by electrolysis. If a scrofulous diathesis exists, the general habits and diet should be regulated, and *calcarea carbonica, calcarea phosphorica, iodine, lycopodium*, and *sulphur* may be given as indicated. Cod-liver oil is often useful. If an arthritic diathesis is apparent, careful protection from cold, regular exercise in the open air, winters in a milder climate, and the use of certain mineral waters, will usually prove sufficient to remove the tendency.

FOLLICULAR TONSILLITIS.

Follicular tonsillitis is so designated for the reason that the brunt of the inflammatory action is borne by the mucous membrane lining the tonsillar crypts. Undoubtedly the majority of cases of tonsillitis originating in the crypts are of an infectious nature. Possibly a few are catarrhal. The streptococcus pyogenes, streptococcus erysipelatosus, the staphylococcus pyogenes aureus and other micro-organisms have been found associated with the various cases. The absence of the Löffler bacillus indicates the non-dependence of this class of cases upon diphtheria. Follicular inflammation seems to be favored by exposure to an atmosphere vitiated by sewage. It also occurs with greater frequency during epidemics of diphtheria.

Symptoms.—The tonsils are swollen, but not as greatly as in the suppurative form. The development is bilateral. The exudation appears in the follicles or protruding and involving the area immediately about the openings of the follicles. These spots of exudation vary in size from two or three to five or six millimetres. Confluence of exudate leads to the development of larger patches. The points of exudation are limited strictly to the tonsils. The lymphatics are swollen.

The general symptoms are quite marked, fever being frequently of high grade within the first few days. A chill is rare.

Diagnosis.—While cases are met in which only bacteriological examinations are sufficient to determine the nature of the disease, it is usually easy to detect this form of tonsillitis by a simple glance at the throat. The most doubtful cases are those in which diphtheritic exudation appears simultaneously at several small points, but the doubt cannot exist long, as the diphtheritic membrane, except in some very mild cases, soon oversteps the tonsillar bounds, appearing upon the palatine arches, velum or pharynx.

Prognosis.—The prognosis is favorable, even active cases recovering within a week. In rare instances frequent recurrences lead to a chronic follicular tonsillitis.

Treatment.—The high degree of fever often present, associated with a marked prostration, requires the patient to remain in bed. Little is required in the way of local treatment; in general I employ none. During the first day or two *aconite*, *belladonna*, and *phytolacca*, are useful according to the symptoms presented by the individual case, but with establishment of the disease, *i. e.*, the appearance of the exudate in its typical form, it will generally be found that *ignatia* will quickly control the symptoms. This medicine has considerable reputation in the treatment of diphtheria, but in my hands its sphere has appeared to be rather follicular inflammation of the tonsil. A few cases may require *bin-iodide of mercury* or *rhus tox.*

HYPERTROPHY OF THE TONSILS.

Etiology.—Age is apparently a very prominent predisposing factor in the etiology of tonsillar hypertrophy, for this condition is observed almost entirely prior to the age of thirty years. Infants are sometimes the subjects of it; and it is even claimed that it may be congenital. The age of puberty seems to be a period especially favoring its occurrence. In many examples of this condition time reduces the size of the enlarged glands; but this fact must not be utilized to favor neglect of the patient, as in many more cases serious results follow.

The majority of cases owe their origin to recurrent attacks of acute tonsillitis, and to incomplete resolution of single attacks. Some follow closely on infectious diseases, as diphtheria, scarlatina, measles and variola. Sometimes tonsillar hypertrophy is produced by an indolent catarrhal state of the throat engrafted on a strumous or syphilitic diathesis.

Pathology and Morbid Anatomy.—All of the constituent parts of the tonsils participate in the pathological process, although in most cases changes in one part or another predominate. Sometimes the lymphoid elements are in excess, and sometimes the fibrous tissues. In the latter case there often ensues an actual atrophy of the lymphoid structures. In the former case the outline of the tonsils is rough and irregular and its consistence soft; the orifices of the follicles are more or less open. The less the fibrous tissue is involved, the more prominent are these features. When connective tissue overgrowth predominates, the surface of the tonsils is smooth, it is not of as intense a color as in the previous instance, often being a mere pink or even gray, and their consistence is firm. These changes are of some practical clinical importance. When lymphoid hypertrophy predominates, but little pain is experienced during the operation of tonsillotomy. When the fibrous

structures are greatly in excess, the knife incises the structures with difficulty, besides causing considerable pain. The divided bloodvessels, moreover, do not retract very readily and troublesome bleeding sometimes follows. The lymphoid variety predominates in childhood; the fibrous in adult life.

Symptomatology.—The majority of the symptoms of tonsillar hypertrophy result from mechanical interference with respiration and the functions of the throat. Many of them are undoubtedly due to enlargement of that mass of lymphoid tissue in the vault of the pharynx, known as the pharyngeal tonsil. Usually they do not assert themselves until the hypertrophy is tolerably well advanced. In typical cases general nutrition is nearly always poor; the patient is pale and cachectic; the mouth is generally held open, and the upper teeth project unduly forward. Finally, mouth-breathing becomes a permanent habit. Even then the amount of air respired is deficient, which is especially apparent during sleep. Respiration is then difficult and noisy, sleep is restless and interrupted by dreams, and not infrequently by sudden attacks of dyspnœa. Sometimes the patient talks or walks during his sleep. These nervous phenomena are believed to result from deficient aeration of the blood supplying the brain. As the case continues the child acquires a peculiar facies; it looks dull, heavy and stupid; its lips are thickened and its nostrils are small, the hard palate becomes unduly arched. The chest may be deformed, the deformity consisting of a circular depression of its walls at about the junction of the lower and middle third. The upper portion of the thorax has an appearance of abnormal prominence.

The voice has a nasal quality as a result of obstruction; it also becomes thick, and the pronunciation of certain consonants, as *e*, *r*, *m* and *n*, is impaired through interference with the function of certain of the pharyngeal muscles.

Hearing is often more or less impaired, not because of the pressure of the enlarged tonsils on the Eustachian tubes as was at one time supposed, but because of the associated naso-pharyngeal catarrh, which may extend to the middle ear, to the impaired functions of the pharyngeal muscles, by the habit of mouth-breathing, and by the pressure of adenoid growths in the pharynx. The sense of smell is impaired by reason of the catarrhal changes in the nasal mucous membrane and by the naso-pharyngeal obstruction.

Besides the general symptoms already detailed, the appetite is poor, digestion is often disturbed, severe spasmodic cough is sometimes annoying, headache is common, especially in the morning, mental action is poor. The gastric disturbances result from two causes: First, the constant swallowing of the increased abnormal mucus produced in the pharynx; and secondly, hurried eating, which is prompted by the non-

enjoyment of the meals, owing to the overproduction of mucus and mechanical interference with deglutition.

Hypertrophy of the lingual tonsil is especially liable to occur in women at the climacteric age. It causes a sensation of fulness in the throat, as from the presence of a foreign body, cough, dyspnœa and disposition to clear the throat.

Diagnosis.—The diagnosis of hypertrophy of the tonsils is made entirely by physical examination. Normally these glands should not project beyond the pillars of the fauces. The extent to which they reach beyond the normal point varies in different cases; they not rarely meet at the median line. In doubtful cases the real size of the tonsils can be learned by palpation, one finger being placed below the angle of the jaw externally, and the other internally on the tonsil. Hypertrophy of the pharyngeal tonsil can be recognized by rhinoscopy or digital examination.

Prognosis.—While, as already intimated, there is a tendency on the part of hypertrophied tonsils to become reduced in size after a lapse of years, this fortunate result generally comes only after very serious damage to the general health. The obstruction of the throat becomes a very serious matter in case of the onset of such diseases as scarlatina and diphtheria. There is a growing opinion to the effect that the tonsils exert an important phagocytic function, which is impaired by their disease. Hence chronic hypertrophy leads to infections which would not take place were the tonsils in a healthy state.

Treatment.—Many authors condemn hypertrophied tonsils to the tonsillotome with hardly a word as to treatment. Enlarged tonsils which contain a large amount of connective tissue and are firm present little hope of improvement from general or medical treatment, and the sooner abscission is performed the better; but in a large number of enlarged organs, having less consistency, proper attention to nutrition, habits of life, and the careful administration of remedies will result in considerable reduction in their size and removal of any annoying symptoms. When the condition present offers any hope of improvement from such measures the attempt should certainly be made. The most satisfactory results have been gained from the use of the *biniodide of mercury.* Personally I prefer the *iodohydrargyrate of potassium. Barium iodide, ferrum iodide, hepar sulphur, sulphur iodide, calcarea carb., calcarea iodide, calcarea phosphorica* and *lycopodium* should all be considered.

I have seen good results from the syrup of *hydriodic acid.*

If the patient has any kind of syphilis, *biniodide of mercury, iodide of potash* and *chloride of gold and sodium* are most important.

The throat should be kept clean, which may be accomplished in these cases by a simple salt-and-water gargle.

DISEASES OF THE PHARYNX.

THE EXAMINATION OF THE PHARYNX.

A conception of the normal appearances of the pharynx, tonsils, and adjacent parts, can only be obtained after repeated examinations of healthy subjects. To inspect the throat thoroughly, it is generally necessary to depress the tongue; this may be done by the ordinary tongue depressor, the handle of a spoon, or the finger. The latter is often preferable in examining children, who are apt to become frightened at the sight of any object resembling an instrument. When the patient is able to expose the throat thoroughly by voluntary effort, instrumental aid is of course unnecessary. Some patients hold the tongue rigidly as soon as the instrument comes in contact with it. In such, steady firm pressure for a few seconds brings about the proper degree of relaxation. If it fails, the local irritability may be lessened by holding small pieces of ice in the mouth for a few minutes. The tongue-depressor should be inserted well back to the base of the tongue, the pressure being exerted in a downward and forward direction. The light may be either direct daylight or reflected from a head-mirror. The physician should stand to the right of the patient with his eyes slightly above the level of the patient's mouth, so that he looks downward as he inspects the throat. When it is desirable to inspect the lower portion of the pharynx, Voltolini suggests that the tongue be drawn out as far as possible, and the tongue depressor inserted far back. This procedure generally induces retching, during which act the lower portions of the pharynx are brought into momentary view. When an examination of the lower pharynx is desired, it is often necessary to use the laryngeal mirror or to insert the finger and examine by palpation.

When searching for a foreign body about the mucous folds of the parts, it is advisable to make use of a blunt probe for separating contiguous parts.

ACUTE CATARRHAL PHARYNGITIS.

Synonyms.—Acute sore throat; angina simplex.

Definition.—An acute inflammation of the mucous membrane of the pharynx.

Etiology.—While strictly speaking age and sex are predisposing

factors in the etiology of catarrhal pharyngitis, as a matter of fact the disease is observed with greater frequency in children and women. Constitutional causes are very frequently important; the disease being liable to occur in persons of a gouty, rheumatic, scrofulous, or syphilitic diathesis, and in chlorotic and debilitated subjects. It is quite often associated with gastro-intestinal disturbances. Some persons seem predisposed to it, for reasons not well understood. Sometimes this predisposition runs in families. Cold and exposure are the most prominent exciting causes; it is frequently caused by traumatism, as from swallowing improper substances, or awkward attempts at local treatment of chronic diseases of the pharynx. Catarrhal pharyngitis is observed as a symptom of quite a variety of the acute infectious diseases; it may be the only manifestation of a mild scarlatina, and it has been observed in association with facial erysipelas, typhus, typhoid and relapsing fevers, measles, rötheln, and variola. Predisposition to attacks is increased by indulgence in tobacco and alcohol, and the prevalent habit of muffling the throat.

Symptomatology.—Many attacks are very light, being represented by some rawness and soreness of the pharynx exciting empty swallowing, and an absence of constitutional symptoms. The onset of a severe attack is rapid and characterized by constitutional disturbances the severity of which varies according to the individual's idiosyncrasies and the extent to which the inflammation involves the parts contiguous to the pharynx. It is very rarely indeed that it limits itself to the pharynx, the uvula, soft palate, and tonsils being involved. An early symptom is fever, which may or may not be ushered in by a chill; the temperature is rarely high. There are pain in the throat aggravated by deglutition, stiffness of the neck and back, general aching, which may be especially located in the joints, headache and thirst. The prominent symptom, however, is the soreness of the throat aggravated during deglutition. Sometimes the pain extends into the ears. The inflammation may involve the Eustachian tubes, in which case disturbance of hearing results. If the laryngeal mucous membrane is involved, the voice becomes hoarse or husky, and there is the characteristic laryngeal cough.

Examination of the pharynx shows its mucous membrane to be highly congested, and covered with a viscid mucus. In severe cases the parts are swollen and even œdematous. The soft palate and uvula very often participate in these changes; the tonsils almost as frequently.

Diagnosis.—Inspection of the pharynx exhibits the evidences of a catarrhal form of inflammation; but as such a condition sometimes constitutes the early stage of more serious forms of disease of the throat, a positive diagnosis had better not be made during the first day, and occasionally, several days elapse before one can be positive as to the true nature of the inflammatory process.

Prognosis.—This is extremely favorable, all cases recovering in from two to seven days.

CHRONIC PHARYNGITIS.

Definition.—A chronic inflammation of any or all of the pharyngeal tissues.

Varieties.—According to the extent of the inflammation the disease is divided into the *diffuse* and *circumscribed* forms. A practical division is one based on the structures attacked. When the mucous membrane alone is involved, it is catarrhal pharyngitis; when confined to the follicles of the pharynx, follicular pharyngitis. According to the pathological changes, we have hypertrophic and atrophic pharyngitis, terms of themselves sufficiently explanatory.

Etiology.—A small proportion only of the cases are observed to occur in childhood, for the reason that the causes operative are observed mostly in adults, or are of such a nature that adults are more exposed to their action, or that long continuance of action is required. Men are unquestionably more frequently affected than are women, because they are more exposed to the causes of the disease. Although an affection in which the local manifestations are prominent, constitutional causes are important etiological factors. The gouty, rheumatic, syphilitic and tuberculous diatheses, and anæmia and general debility, all favor its development. It is sometimes dependent upon diseases of distant organs, especially gastro-enteric disturbance, and it is claimed by some to be due to uterine disease. Dyspepsias associated with acid eructations are far more liable to produce pharyngitis than are other varieties. Too free indulgence in highly seasoned food accounts for some cases. The personal habits of the individual are frequently the source of chronic pharyngitis, excessive indulgence in tobacco and alcohol being among its most common causes. The excessive and uneducated use of the voice, especially in poorly ventilated rooms, and in the open air, is a frequent cause of the disease in public speakers and singers. Some cases arise from exposure to cold, and others are the result of repeated attacks of acute pharyngitis.

Dust, noxious gases, and nasal obstruction are mechanical causes. The latter seems to be operative especially in cases in which the obstruction is due to hypertrophy of the turbinated bodies. It is a matter of interest in this connection to note that nasal obstruction dependent upon nasal polypus is only infrequently associated with chronic pharyngitis.

Pathology and Morbid Anatomy.—In those cases in which the inflammation is limited to the mucous membrane, there is simply a congestion of that structure associated with an overactivity of the glands resulting in the outpouring of mucus presenting different characteristics. The palate and fauces are relaxed, which has led to this condition

receiving the designation of "relaxed throat." Sometimes the mucous membrane is infiltrated and thickened, and the surface of the pharynx coursed by enlarged bloodvessels.

The follicles are enlarged only in follicular pharyngitis. They appear as small "split-pea" elevations, occurring in considerable number over the posterior pharyngeal wall, and are of a yellowish-white or dull-red color. It is this form of chronic pharyngitis which is generally known as "clergymen's sore throat." Its onset is explained by congestion excited by faulty vocalization and exposure to cold. The glandular elements become abnormally active and their secretions are retained with resulting distention. Long continuance of this state results in narrowing of their ducts and general thickening of the tissues. The retained secretion becomes inspissated, and is sometimes expelled during fits of coughing as small cheesy lumps having a very offensive odor. When the elevations are numerous they may coalesce.

In the late stages of chronic pharyngitis the mucous membrane undergoes atrophy (*pharyngitis sicca; atrophic catarrh*). In this condition the secretion is scanty, and may even take the form of dried plugs or of scales of mucus.

Symptomatology.—Many cases of both the catarrhal and follicular varieties exist without producing sufficient local discomfort to attract the patient's attention. In such the objective symptoms only are present, or simply a slight dryness of the throat is experienced. In more marked cases the voice is greatly interfered with, becomes husky, the dryness of the throat is a source of considerable discomfort, and there is more or less hawking of mucus. When the larynx is involved in the process, disturbance in phonation is marked, and cough becomes a prominent symptom.

The discharged mucus may be thick or thin, clear, white, green, bloody, or lumpy. The pathological process may extend to the Eustachian tubes, thus producing more or less serious disturbances of hearing. When the soft palate and uvula are involved the patient may experience an annoying cough.

Prognosis.—In chronic catarrhal pharyngitis the prognosis is favorable if the disease has not been of too long continuance and marked hypertrophic changes have not been set up. In all cases patience is required in pursuing the treatment. Chronic follicular pharyngitis presents a more uncertain outlook, and is only curable when the patient assists the treatment by giving the voice rest. Atrophic pharyngitis is well-nigh incurable.

ULCERATIONS OF THE PHARYNX.

Ulcerous Pharyngitis (*angina ulcerosa, ulcerated sore throat*).—This is a form of indolent ulceration of the throat occurring for the most part

in debilitated and cachectic individuals exposed to septic influences. It is sometimes observed, therefore, among medical students engaged in dissecting, among hospital nurses, and during the course of epidemics of scarlatina and diphtheria. The ulcers vary in number and size. They are somewhat elevated, and are of a yellowish-white color. Severe pain is experienced during deglutition, especially during attempts at swallowing saliva. The tonsils are somewhat swollen, and frequently are involved in the ulcerative process. Constitutional symptoms are marked. Prostration is present; the pulse is weak; the temperature elevated; and the appetite decidedly deficient.

Follicular Ulceration of the Pharynx.—The title designates the character of the ulceration. The ulcers are small and superficial, and nearly always associated with chronic pharyngeal catarrh.

Tubercular Ulceration is exceedingly rare in the pharynx except when secondary to tuberculosis elsewhere. It may be either acute or chronic, generally the latter. The ulcers are irregular in outline, and have grayish-yellow bases. They are remarkable for the severe pain they occasion. The usual constitutional symptoms of tuberculosis are present.

Syphilitic Ulceration of the Pharynx has been previously described (see Vol. I, p. 417).

Diagnosis.—The chronic character of the disease and the attendant symptoms are sufficiently characteristic to prevent any error in diagnosis in the case of either angina ulcerosa or follicular ulceration. Syphilitic and tubercular ulcerations may be confounded. The former are characterized by their indolence and comparative absence of pain. The ulcerations, moreover, present well-defined borders, and are surrounded by well-marked hyperæmic areas, all of which characteristics are wanting in tubercular ulcerations. In the latter condition the mucous membrane is often unnaturally pale, and in the beginning of the process is studded, especially over the posterior pharyngeal wall, with grayish subepithelial granulations. These subsequently become yellowish in color and ulcerate.

Prognosis.—In angina ulcerosa and follicular ulceration the prognosis is favorable. Tubercular ulceration until recently presented a practically inevitably fatal issue, the disease running its course in from a month to six weeks. Recent methods of treatment have cured some cases. Syphilitic ulceration responds readily to proper treatment in nearly all cases, although permanent whitish cicatrices often remain.

HERPETIC PHARYNGITIS.

Synonyms.—Herpes of the pharynx; membranous pharyngitis; aphthous pharyngitis.

Etiology.—Herpetic pharyngitis seems to be dependent upon

exposure to cold more frequently than upon any other cause. It is observed with especial frequency in the fall and spring months, and in damp, cold climates. It has a decided predilection for women and children, and delicate subjects generally. Its relationship to diphtheria is of more than usual interest. The disease seems to be especially prevalent during epidemics of that disease, and its differentiation from diphtheria is ofttimes impossible without bacteriological investigation. Some cases have been ascribed to reflex influence and local irritation.

Symptomatology.—The disease is ushered in by soreness of the throat aggravated by swallowing and by fever and general malaise. Inspection of the pharynx shows the presence of successive crops of vesicles upon the mucous membrane of the pharynx, soft palate, and even on the mouth and tongue. They are apparently identical in character with the aphthous ulcerations of the mouth described in a previous article (see page 477). These vesicles rupture after from twenty-four to forty-eight hours, leaving small superficial circular ulcers. When very numerous they coalesce and become covered with a false membrane closely simulating that of diphtheria. Cases have been reported in which pharyngeal herpes has been associated with the same eruption in distant parts of the body.

Diagnosis.—If seen in the early stage the recognition of the vesicular character of the lesions makes a diagnosis easy. Many cases, however, are not seen at this time, and only come under the physician's observation when the false membrane has formed upon confluent lesions. The presence of circular ulcerations apart from the membrane, or the unusual translucency of the latter, is always suggestive of herpetic pharyngitis. Sometimes a differentiation is utterly impossible even by the most experienced clinicians. The only reliable diagnostic test remaining is a bacteriological examination and inoculation experiments.

Prognosis.—The prognosis is favorable. Exceptions are observed only in cases which take on secondary diphtheritic infection, some of these ending fatally.

PHLEGMONOUS PHARYNGITIS.

Two distinct affections have received the name of phlegmonous pharyngitis; one is variously known as *peritonsillar abscess, peritonsillitis abscedens,* and *pharyngitis abscedens;* the other, as *acute infectious phlegmonous pharyngitis, acute septic phlegmon of the pharynx,* and *cellulitis phlegmonosa pharyngis.* While both are serious affections the latter is decidedly so, being invariably fatal.

Etiology.—Peritonsillar abscess may be regarded as bearing a close similarity to quinsy, the only difference between the two conditions being the difference in the location of the lesion. Cold is a prominent cause, and is especially operative in persons who have been debili-

tated by insufficient food and general hardships. Traumatic causes play a part in the etiology of some cases, as those arising from the taking of too hot food and drink, the ingestion of corrosive poisons, and the therapeutic application of strong caustics. Infection is believed to be a prominent factor in many cases. Peritonsillar abscess sometimes follows certain of the acute infectious diseases, as typhoid fever, scarlatina, variola, measles, and typhoid fever.

Acute septic phlegmon is an exceedingly rare disorder arising solely from infection. It is regarded by some (Guttmann) as identical with erysipelas of the pharynx. It may attack persons in the midst of good health.

Symptomatology.—Peritonsillar abscess is ushered in by both local and constitutional symptoms of a violent character. Subjectively the former consist of very severe pain aggravated by the slightest attempt at swallowing. Objectively, the affected parts swell rapidly, the tonsils often participating in the inflammation. They assume a deep purplish hue and become highly œdematous. The throat is filled with a muco-purulent secretion which becomes purulent when the abscess ruptures.

The constitutional symptoms are always marked. The disease is ushered in by a severe chill, followed by high fever. Headache is often intense. The pulse is rapid. Sometimes delirium ensues. The tongue is heavily coated, the saliva profuse, and the breath exceedingly fœtid. Prostration is frequently profound; respiration is embarrassed by the intense swelling of the parts, becoming a serious symptom should the inflammation extend to the larynx, as it sometimes does.

When the abscess opens, it is usually through the anterior palatine arch, followed by prompt relief of symptoms. This fortunate result is usually brought about during the acts of coughing or swallowing. Still it has occurred during sleep and may occasion dangerous asphyxia from the flowing of pus into the larynx.

Acute septic phlegmon begins with a high degree of congestion and œdema of the soft palate and pharynx which increases rapidly. Soreness of the throat is present, also fever, but the latter symptom is not usually of high grade. Prostration is marked from the very beginning. The patient passes rapidly into the so-called typhoid condition. The urine is highly albuminous. Death occurs in the course of three or four days. Post-mortem examination reveals a high degree of congestion of the kidneys and spleen, and purulent infiltration of the pharynx and contiguous parts.

Prognosis.—Peritonsillar abscess runs a course ranging from five to fourteen days, the minimum period being the one when suppuration does not ensue. Cases in which the pus does not find a ready outlet sometimes offer a serious prognosis because of infiltration of neighboring

parts by the pus, even ulceration of the great bloodvessels, and generally, septicæmia, following this complication.

Acute septic phlegmon is always fatal.

GANGRENOUS PHARYNGITIS.

This is a very rare disease, which may occur secondarily to any of the pharyngeal affections already mentioned, but usually following certain infectious disorders, as typhoid fever, scarlatina, diphtheria and measles. Gangrenous pharyngitis is ushered in by sore throat and high fever. Inspection shows several black or greenish spots in various portions of the throat. These increase in size and become the seat of ulceration. The breath is horribly fœtid. Later, the temperature falls and great prostration sets in, with cold extremities, feeble pulse, diarrhœa, etc.

ERYSIPELAS OF THE PHARYNX.

Etiology.—Erysipelas of the pharynx is dependent upon the same cause as that of erysipelas in any other portion of the body, *i. e.*, infection with the streptococcus of Fehleisen. The disease is generally secondary, resulting from the spread of erysipelas from some neighboring structures. Sometimes the infection takes place in the pharynx and spreads to the external surface.

Symptoms.—The early symptoms are much the same as those of the various acute inflammations of the pharynx. Sometimes fever precedes the appearance of local symptoms by a few days. The local manifestations consist of redness, swelling, œdema and sometimes blisters. Glandular involvement is generally observed. The constitutional symptoms are prominent. The diagnosis is not an easy matter, excepting in those cases in which erysipelas in other portions of the body is present.

Prognosis.—Erysipelas of the larynx is a serious disorder, especially when the tendency to spread downward is manifested.

RETROPHARYNGEAL ABSCESS.

Definition.—An abscess occurring in the connective tissue between the pharynx and the vertebral column.

Etiology.—Nearly all cases of retropharyngeal abscess occur in children, boys and girls being affected with about equal frequency. In the majority of instances it is said to be idiopathic, a statement that may be regarded as a confession of ignorance as to the origin of the attack. The tubercular and syphilitic diatheses undoubtedly favor the occurrence of the disease. In adults, syphilitic disease of the vertebræ is nearly always the cause of the trouble. Some cases are secondary to naso-pharyngeal disease and the acute infectious disorders. Sometimes it is the result of caries of the cervical vertebræ.

Pathology and Morbid Anatomy.—The tissues posterior to the pharynx are richly supplied with lymphatic glands, and it is these structures which, under favoring circumstances, take on inflammatory action, and finally undergo suppuration. The abscess may be situated opposite any portion of the pharynx, although it is observed far more frequently in the upper half. The structure of the post-pharyngeal tissues is such as to favor the burrowing of pus, in some cases even into the mediastinum.

The pathology of retropharyngeal abscess, secondary to spinal caries, is that of tubercular infiltration and degeneration.

Symptomatology.—The indolent character of the inflammation is such that few symptoms appear until the size of the abscess gives rise to trouble by reason of its mechanical influence. The onset is therefore insidious. In some cases slight pain in the palate or deep-seated soreness in the pharynx is complained of. There next appears a stiffness of the throat or slight difficulty in swallowing, which gradually increases in intensity. The respiration is embarrassed, especially if the abscess is situated about the lower portion of the pharynx. Dyspnœa may appear and prove a most distressing symptom, sufficient to cause cyanosis, and in young children, convulsions.

Examination of the affected parts reveals the presence of an even-surfaced tumor, covered by dusky-red mucous membrane. Under palpation it has a semi-elastic doughy feel, which changes to fluctuation with the advent of suppuration.

Constitutional symptoms are not generally very prominent. At first there may be slight chilly feelings, or if the inflammatory action is acute, a well-marked rigor. The pulse is more or less rapid, and there is a slight rise in temperature. Headache is commonly present. Digestive symptoms complicate some cases.

Diagnosis.—With a history of difficult deglutition, dyspnœa, pain in the throat, and the presence of a pharyngeal tumor with uniform surface, the diagnosis of retropharyngeal abscess is an easy matter. When, however, the abscess is deeply situated, it may be mistaken for certain laryngeal affections, notably œdema of the larynx and croup. The dyspnœa of laryngeal œdema is similar to that of retropharyngeal abscess. In the case of the latter affection, it may be relieved by lifting the larynx above the seat of obstruction; in œdema of the larynx the dyspnœa is not relieved by this manipulation.

Croup is distinguished by interference with phonation, which is undisturbed in retropharyngeal abscess.

Retropharyngeal hæmatoma may present a confusing resemblance to abscess. The history of the case, the absence of pain, and the use of the exploring needle should prevent diagnostic error.

In all suspicious cases careful digital examination of the deeper

portions of the pharynx should be made in order to establish the diagnosis.

Prognosis.—The duration of retropharyngeal abscess varies within wide limits. Some very acute cases run a course of but a few days; others last for months. The disease must always be regarded as a serious one, although the majority of cases make excellent recoveries. Danger arises from the exhaustion dependent upon long-continued suppuration, the burrowing of pus, and from the escape of pus into the larynx as the result of sudden rupture of the abscess. Sometimes the abscess opens into the mediastinum, the œsophagus, or one of the pleural cavities, in each case greatly increasing the danger of the disease.

RHEUMATIC PHARYNGITIS.

This is a form of pharyngitis occurring in rheumatic individuals following usually exposure to cold. It sometimes occurs in association or alternates with rheumatic manifestations elsewhere.

Symptomatology.—The patient complains of more or less severe pain in the throat, which may or may not be accompanied by increased redness of the pharynx. The pain is greatly aggravated during deglutition. The uvula is often œdematous. But all these phenomena, like other rheumatic manifestations, are fugacious. Ofttimes, indeed, they disappear suddenly, within a comparatively few hours of their onset, leaving the patient well, sometimes being followed by rheumatic joint troubles. The diagnosis of this interesting affection cannot be made excepting by a knowledge of the history of the patient, for attacks of rheumatic pharyngitis are prone to recur rather frequently. The disease is not a serious one, rarely lasting more than a few days.

A form of sore throat is occasionally observed in connection with the gouty constitution. Most of the cases are chronic.

THE TREATMENT OF THE VARIOUS FORMS OF PHARYNGITIS.

When there is a predisposition to some form of sore throat the general health should be investigated and an attempt made to eradicate the tendency. If an acute form of sore throat is due to a chronic affection of some portion of the throat or related mucous surfaces, radical treatment should be adopted during the intervals between acute or subacute attacks. The possible existence of tuberculosis, lithæmia, rheumatism, or some diathetic state must be considered. Useless muffling of the throat must be avoided, and cold bathing followed by friction established as a daily habit. Exposure to cold and damp should be guarded against, and suitable underclothing worn during the entire year. Daily exercise in the open air is not the least important of preven-

tive measures. Change of air, especially to a mild winter climate, is advisable in troublesome cases.

In the acute varieties inhalations of steam often afford considerable relief, but they must be employed frequently and as concentrated as possible. Care must be exercised during their use for children to avoid burning. Gargles of hot water sometimes help if they are begun early, also the swallowing of small pieces of ice after they have been smoothed by the warmth of the mouth. Painting the pharynx frequently with pure glycerin depletes the mucous membrane, and is of especial value in the chronic forms of pharyngitis. Sprays of liquid vaseline or alboline are soothing and protective, and these oils medicated with menthol (ten to twenty grains to the ounce of oil) are of very positive value in controlling the inflammatory process. Sprays of cocaine should not be used on account of the paresis of the bloodvessels which follows upon their primary contraction, favoring a protraction of the inflammatory process. Hot poultices to the neck relieve pain. Some advise ice, but whether hot or cold applications are selected, they should be begun early, and intelligently and persistently applied. Enlarged follicles may be treated by means of a glycerole of iodine or a saturated solution of pyoktanin blue, applied daily, and if symptoms continue, each follicle should be treated at its centre with a needle attached to the negative pole of a galvanic battery, the positive pole being held in the hand; or, better, they may be lightly touched with the galvano-cautery, which causes absorption and shrinkage of that portion of the gland which is not destroyed. It is frequently observed that symptoms are relieved without disappearance of the enlarged follicles, indicating that their destruction is therefore not always essential to relief. Associated nasal and post-nasal lesions should receive proper attention at the same time. The curette may be employed for the treatment of the post-nasal overgrowths.

Collections of pus should be evacuated, whether located behind the pharynx (retro-pharyngeal-abscess) or in the tonsils. In retro-pharyngeal abscess the patient should be placed in the position for operations upon cleft-palate, otherwise the pus may flow into the larynx when the abscess is incised. In tonsillitis the puncture should not be made until the abscess is well formed, care being exercised to avoid wounding bloodvessels of size, an accident which has frequently occurred.

In detailing indications for the use of medicines symptoms relating to the associated cavities must be considered in some degree on account of their frequent existence in connection with disease of the pharynx.

Guaiacum. This remedy has been considerably employed in the treatment of phlegmonous tonsillitis of rheumatic origin and with much success. The author, however, has called attention to its value in simple catarrhal pharyngitis (sore throat), for which affection it has proven more

generally successful than any other medicine. It should be promptly administered in the early stage. A good preparation is essential, the test of which is the degree of peppery sensation excited in the throat. It is best administered in the form of freshly medicated disks, which should be frequently administered, and slowly dissolved upon the tongue. *Belladonna* has been the most generally employed medicine for the various forms of pharyngitis. It is of little value in the ordinary catarrhal variety. It is indicated by dryness, swelling, bright redness, throbbing, headache, etc. It is of especial importance in the forms of pharyngitis due to erysipelas and certain of the infectious diseases, notably scarlatina. I have found it more active in the first decimal dilution or in the tincture. *Aconite* is much neglected in throat inflammations, to the incipient stage of the more intense forms of which it is particularly suitable, *i. e.*, during the first forty-eight hours of the attack, while congestion is intense. Simple catarrhal pharyngitis of severe character, and erysipelatous pharyngitis, are the forms which most frequently respond to its action. The rheumatic form, according to Hughes, seldom requires any other medicine. It is frequently necessary to decide between aconite and belladonna, but the anxious, nervous, restless aconite patient is the antithesis of the belladonna one. *Apis* is called for when œdema is added to a pale, inflammatory redness. The type of inflammation matters little, even diphtheria in epidemic form often yielding to apis when œdema is pronounced. *Lachesis* should be considered when hyperæsthesia and pain are in apparent excess of what the lesion should cause. The hyperæsthesia may involve the external as well as the internal parts. Lachesis should always be considered if there is an associated blood infection, as in erysipelas, gangrene, etc.

Biniodide of mercury or the *iodohydrargyrate of potassium* are preeminently indicated by ulcerative action, *e. g.*, such as attends scarlatina. There are constitutional infection and swollen lymphatics at the angles of the jaw. The second decimal trituration of the former and dilution of the latter should be persistently administered. These medicines have quite displaced *mercurius* in my experience. *Phytolacca* relieves many sore throats of an acute character. There may or may not be ulceration or an exudate. The lymphatics may be involved. The most important symptom in differentiating is the pain, which may be of an ill-defined character, involving the body generally, or certain areas, thus resembling myalgia or rheumatism. Phytolacca has proven most useful in catarrhal pharyngitis, in the early stages of diphtheria, and in rheumatic pharyngitis. *Arum triphyllum* has been of most service in the acute pharyngeal inflammation attending infectious disease especially scarlatina. Its preeminent indication is involvement of the orifices (mouth and nose), which become very sensitive, excoriated, and may crack and bleed. The entire mucous membrane of the mouth and other related passages may be dry,

red, and the epithelium extensively exfoliated. The discharges are often of a highly irritating character. *Rhus toxicodendron* gives good results in rheumatic or herpetic pharyngitis and in pharyngitis due to the infections (erysipelas, diphtheria, variola, etc.). The inflammation is phlegmonous, there may be an exudate, the lymphatic glands are greatly enlarged, there are marked prostration and a tendency to the development of the group of symptoms representing the typhoid state. The tissues may be œdematous. *Kali bichromicum* is prescribed mainly upon the character of the discharges, which are exceedingly stringy, but it is equally suitable to dry pharyngitis with a red, glazed appearance. The mucous membrane even of the tongue is denuded of much of its epithelium, the stomach is irritable, nausea and vomiting being prominent symptoms. In some forms of inflammation of the throat attended by hard swelling of the lymphatic glands and sticking pains *kali carb.* has succeeded. *Iodide of arsenic* is sometimes useful for follicular and other forms of pharyngitis occurring in feeble cachectic persons. It is best suited to elderly people whose cardio-vascular tissues are degenerated or who are subjects of tuberculosis.

In the follicular form consider *hydrastis, iodide of arsenic, sanguinaria, nitrate, sulphur* and *iodide of sulphur. Iodine, hepar, selenium, seleniate of soda, stannum* and *stannum iodide* are useful when laryngeal or bronchial symptoms are associated.

For the phlegmonous and gangrenous forms of pharyngitis study *arsenic, lachesis* and *secale.* Free stimulation is usually necessary and the use of *peroxide of hydrogen* as a cleansing agent, followed by a powder of *permanganate of potash,* blown upon the surface (Vol. I, page 227), or applications of a saturated solution of pyoktanin blue.

In tuberculous ulceration the skillful use of the curette followed by applications of *lactic acid,* in solutions not weaker than thirty per cent., has affected some cures.

The throat lesions of syphilitic subjects are usually controlled by the use of *iodide of potassium* or the *biniodide of mercury.* Occasionally benefit follows the use of *hepar, cuprum sulph., nitric acid* or *aurum muriaticum.*

Retropharyngeal abscess demands the remedies suitable to abscess in any location, viz., *hepar, silicea, calcarea carb., calcarea phos., calcarea sulph., fluoric acid,* etc. The treatment in many cases resolves itself into that for chronic bone disease. A nutritive diet, cod-liver oil, and life in the open air, are important items of treatment.

NEUROSES OF THE PHARYNX.

The motor disorders of the pharynx, paralysis and spasm have already been described. (See Vol. I, p. 578.) Under the above heading are considered certain functional sensory disorders affecting this region of

the body. *Anæsthesia* of the pharynx is sometimes a hysterical symptom. Oftener, however, it is symptomatic of some organic disease, as bulbar paralysis. Its most common cause is diphtheritic paralysis, of which, indeed, it may afford the only evidence. It gives rise to but little inconvenience, excepting when it is well marked, in which case food is very liable to pass into the larynx.

Hyperæsthesia of the pharynx is exceedingly common. It is a condition normal to many people. In some cases it is purely mental. Physicians have observed examples of this in patients undergoing local treatment of the throat, who retch even before the application is made. It is observed with especial frequency in the nervous and hysterical. It is sometimes caused by local conditions, as pharyngeal catarrh and varicose veins at the base of the tongue.

Paræsthesiæ of the pharynx are also not uncommon. They are generally observed in women, especially after the removal of a foreign body, the idea taking possession of the patient that it has not been removed.

Neuralgia of the pharynx is not often met with. It consists of severe darting pains in the part. Examination with the probe usually detects one point of maximum sensitiveness. It generally occurs in neurotic subjects.

The *treatment* of these conditions is closely associated with that of the general health. Any means which improves the nutrition will favor the diminution of morbid sensitiveness of the pharynx, and remove anæsthesia and paræsthesiæ, if not due to organic disease. Such remedies as *aconite, belladonna, gelsemium, mercurius, nux vom.*, and *aur. mur.*, are most likely to be indicated by the local symptoms, but the general group may call for others of most diverse character.

AFFECTIONS OF THE ŒSOPHAGUS.

METHODS OF EXAMINATION IN DISEASES OF THE ŒSOPHAGUS.

The methods available for the physical examination of the œsophagus are auscultation, sounding, and inspection. The former two may be employed by the general practitioner; the last requires special apparatus and a high order of technical skill for its successful application, so that its description will be omitted from this section.

Auscultation of the Œsophagus.—Examination of the œsophagus by auscultation is based upon the fact that food and liquids in their passage through this tube cause certain sounds, which in case of alteration in the calibre or muscular coat of the œsophagus, differ from the sounds heard in health. Auscultation is best practised with the aid of a stethoscope, which should be placed on the back of the neck or on the back over the course of the œsophagus. In some cases it may be performed low down and also on the side of the neck. Simple as the process appears to be, much care is required for its practice. It is necessary to be thoroughly conversant with the normal sounds of deglutition, and to carefully auscultate each inch of the œsophagus from pharynx to stomach. After the stethoscope is placed in position the patient is directed to swallow water, or better still, some thickened fluid, such as arrow-root gruel. If the stethoscope is placed on the side of the neck at the level of the hyoid bone, deglutition produces a sound which has been described as represented by the word "glouglou" spoken in a loud whisper, and is known as the pharyngeal sound. It is due to the passage of air and liquid into the pharynx. It also tends to obscure the true œsophageal sound heard with the stethoscope on the back and over the œsophagus. An error from this source may be obviated by directing the patient to drink continuously but slowly, which lessens the quantity of air taken in. The œsophageal sound has been described as a sharp and sudden one, ceasing suddenly. In listening, it is important to observe not only the quality of the sound, but its duration, and its relation to the time when the act of swallowing is begun. It may be feeble in the case of organic strictures; sometimes it is altered in the direction of a confused and bubbling noise. To determine the quickness of the sound, one finger is placed over the hyoid bone while listening. It is then possible to note the time intervening between the begin-

ning of deglutition, as marked by the rising of the hyoid bone, and the time when the sound is heard over the œsophagus. Regurgitation of food may also be determined by auscultation, and may be due to either organic or spasmodic stricture. In the former an appreciable time elapses between the going down and the coming up of the food; in the latter, it is prompt and the ejection is more forcible. By carefully listening over every portion of the œsophagus, points of obstruction may be detected.

Sounding the Œsophagus.—This is best practised with bougies, ovoid in cross-section, and ranging in diameter from three to fifteen millimetres. They are made of rubber and are flexible. The manner of using them is self-evident. In case of suspected stricture or œsophageal obstruction, one of the smaller sizes is chosen and passed. If it can be readily introduced, larger sizes are successively employed until one finds an instrument which is not capable of passing the obstructed point. The distance of this from the edge of the teeth is carefully noted. In every case the manipulations must be gentle. It is also important that after passing the obstruction the instrument should be introduced as far as the stomach, for there may be other strictures of smaller calibre lower down.

Œsophagoscopy is performed with the aid of special instruments. It enables the skilled observer to discover the appearances of the mucous membrane, the presence of ulceration, etc.

ACUTE ŒSOPHAGITIS.

Definition.—Inflammation of the œsophagus.

Etiology.—Acute œsophagitis, from whatever cause it may arise, is very rare. It may, however, occur as a result of an acute inflammation extending from adjoining structures, as the pharynx above or the stomach below. As a primary affection its occurrence has been attributed to the drinking of ice-water, muscular strain, hot drinks and food, traumatism, chemical action, and rheumatism. The traumatic cases are produced by the swallowing of rough foreign bodies or the bungling introduction of instruments. Œsophagitis from chemical action is usually the result of suicidal attempts, and follows the ingestion of the mineral acids, strong alkalies (generally lye or household ammonia), corrosive sublimate and antimony. Following the taking of antimony, it may occur as a result of injudicious medication with that drug. As to the rheumatic cases, it is a question whether or not the actual lesion is a myalgia.

Acute œsophagitis seems to be comparatively common in young infants, probably because of the normally congested state of the mucous membrane of the œsophagus at birth. Its exciting cause is the sore nipples of the mother, defective quality of the breast milk, or improper

feeding. A mycotic variety of œsophagitis may also occur in infants, and is due to the extension of thrush from the mouth or throat.

As a secondary affection, œsophagitis may occur during the course of diphtheria and other infectious diseases. It may be secondary to other pathological processes in the œsophagus, *e. g.*, cancer, or stricture with retention of food, and may also result from constitutional diseases such as nephritis, tuberculosis, syphilis, and pyæmia.

Pathology and Morbid Anatomy.—The pathological appearances in the ordinary case of catarrhal œsophagitis differ in no wise from those observed in catarrhal processes in other situations. The mucous membrane is reddened, swollen, and bathed with an increased secretion of mucus. The natural tendency of the inflammation is to subside under proper treatment, so that as a rule the process undergoes resolution. Sometimes ulceration takes place, usually, however, under the influence of definite exciting causes, such as the ingestion of hot or corrosive substances, irritation caused by foreign bodies, and the membranous inflammation of diphtheria. In traumatic cases suppuration may ensue. Such a termination is very rare; still more so is gangrene.

Symptomatology.—The characteristic symptom of acute œsophagitis is severe pain on swallowing, extending down the entire œsophagus and sometimes associated with a constant dull pain beneath the sternum and in the back between the shoulders. This pain is described by the patient as of a severe burning-tearing character. Between the acts of deglutition a dull soreness is experienced. Pressure on the larynx and trachea from before backward discovers a sensitiveness when the inflammation involves the upper end of the tube. Even such slight movements as those of the muscles of the larynx during phonation may aggravate the suffering and cause the patient to refrain from talking. If the swelling of the mucous membrane is well-marked, a sensation as of a foreign body in the throat may be complained of. The patient holds the head stiffly, and takes care not to turn it to either side lest the sufferings are intensified. Attempts at swallowing are sometimes followed by reflex spasm, causing violent ejection of the ingesta. This phenomenon is generally due to narrowing of the œsophageal calibre by the swelling of the mucous membrane, the weakening of the muscular walls by the inflammation, and the hyperæsthesia of the parts. Sometimes the regurgitated matters are found to contain, besides the substances swallowed, considerable blood-stained mucus. When the inflammation has gone on to suppuration, rupture of the abscess is attended by ejection of pus. As in most inflammatory affections there is thirst, but it is greatly intensified because the patient is unable to appease it by drinking. The inflammation may extend to the ary-epiglottic folds, in which case dyspnœa becomes an important symptom. Fever, though usually present, does not attain a high point, the temperature rarely reaching a

higher point than 102° F. The advent of suppuration is marked by the appearance of rigors and increased intensity of the local phenomena, all of which are promptly relieved on the evacuation of the abscess.

In the case of œsophagitis arising from the taking of irritant poisons, there are, besides the history of the case to guide us, the discovery of bottles containing the poison, and the local action of the chemical on the mouth and throat. Laryngoscopic examination reveals changes in the epiglottis and arytenoid cartilages, which may be much swollen and œdematous. The symptoms appear immediately after taking the poison. Owing, however, to the destruction of tissues, sensation is blunted, and pain is not as prominent a feature of the case as in the acute idiopathic variety. Vomiting is prominent and causes the expulsion of shreds of mucous membrane and much blood-stained mucus.

Diagnosis.—The diagnosis of acute œsophagitis depends upon the severe pain during deglutition following the course of the œsophagus, the sensitiveness of that structure to pressure, and the absence of physical signs pointing to disease of the pharynx, larynx, trachea, or pericardium. The inability to swallow liquids and the violent ejection of the same which may follow the attempt, may lead the observer to suspect hydrophobia. The latter disease, however, has a general hyperæthesia, paroxysms of asphyxia, and marked mental symptoms, which are all absent in œsophagitis. Inspection of the throat and the use of the laryngoscope demonstrate that the painful deglutition is not due to disease in either the pharynx or larynx. It is said that pericarditis with marked effusion may produce dysphagia. The pain, however, in such cases, is rarely considerable, and is generally most marked in the epigastrium. Physical examination demonstrates the usual signs of pericardial effusion.

Prognosis.—The prognosis of acute œsophagitis is generally favorable, most cases making a good recovery in a few days. When convalescence is once established it proceeds very rapidly. Cases resulting from strong acids or alkalies are very prone to be succeeded by cicatricial stenosis of the œsophagus. Such cases are serious, however, from their very beginning, and the restoration to health is a slow process. Ulceration is dangerous because of the possibility of perforation, which occurs rarely. Diphtheritic inflammation of the œsophagus is highly fatal.

Treatment.—The first element in the treatment of this disease is absolute rest. If swallowing is very painful all food and drink must be prohibited and alimentation carried on by the rectum. Relief from pain may be secured in a measure by the application of hot poultices over the spine. When thirst is intense it may be allayed by giving the patient small pieces of ice, providing the swallowing does not produce too much discomfort. In no case should the sound be used, as it can do much harm. On the subsidence of the inflammation care must be exercised in permitting a return to solid food.

The remedies are those adapted to inflammatory processes in mucous membranes in general. *Aconite*, in the beginning of the catarrhal cases, particularly when produced by cold. *Gelsemium* may also be thought of in this connection. *Belladonna* is suited to cases associated with intense pain, fever, marked œsophageal spasm, and sensitiveness to pressure. *Rhus* and *bryonia* are adapted to the rheumatic or myalgic cases; *mercurius viv.* and *mercurius corrosivus* to severe cases presenting symptoms similar to those calling for belladonna, but at a later stage of the disorder.

Cases arising from poisons require the administration of appropriate antidotes, which vary according to the nature of the substance which it is desirable to neutralize, followed by liquid food and the use of *mercurius cor.*, *rhus tox.*, *arsenic* or *cantharis.*

STENOSIS OF THE ŒSOPHAGUS.

Definition.—The term œsophageal stenosis is used to designate a narrowing of the calibre of the œsophagus dependent upon cicatricial contraction or thickening of its walls, or from the pressure of tumors from without, or encroachment upon its lumen by tumors of the œsophagus itself. Scientific accuracy limits the use of the term to cases of cicatricial contraction.

Synonym.—Œsophageal stricture.

Etiology.—In the vast majority of cases stricture of the œsophagus is the remote result of poisoning by acids or caustic alkalies. Such accidents are of especially frequent occurrence in small children, hence the condition under consideration is often encountered in childhood. Sometimes it results from the cicatrization of an ulcer produced by a foreign body. Stenosis of the œsophagus has been known to occur from the impaction of a foreign body in that tube; from syphilitic, tuberculous and variolous ulcerations, and inordinate thickening of the walls of the œsophagus consequent upon chronic inflammation. It is said that the condition may be congenital.

Pathology and Morbid Anatomy.—Stricture may involve any portion of the œsophagus, but it is especially liable to occur in the lower third. Usually it is about two or three inches in length, but may involve the entire tube. The walls of the œsophagus are, as a rule, greatly thickened. The extent to which its lumen is narrowed varies greatly in different cases, and in different parts of the œsophagus in the same case. In some instances the stenosis may be complete. The mucous membrane of the affected part may be thrown into folds, be traversed by bands or fibrous ridges, or it may be entirely replaced by cicatricial tissue. Dilatation of the œsophagus above the seat of obstruction is sometimes observed.

Symptomatology.—The important symptom of œsophageal stenosis

is difficult deglutition or dysphagia. As a rule, it is of gradual onset. Sometimes, because of spasm or sudden swelling of the mucous membrane, its appearance is rapid. An examination into the history of the case usually discovers that some time previously the patient suffered from irritant poisoning or an acute œsophageal ulceration from some cause, followed by recovery and gradual disappearance of the painful deglutition, leaving the patient comparatively well, until the dysphagia appeared for which relief is now sought. The time intervening between the disappearance of the primary disease and the manifestation of symptoms of stenosis ranges from a few days to three months.

In the beginning the dysphagia is manifested by inability to swallow large solid particles of food. Later this is found to be impossible unless deglutition is aided by drinking freely of fluids. As the trouble increases the patient is forced to partake of food of less and less consistence, until the stricture reaches such a stage that fluids only can be swallowed. Food may accumulate in the œsophagus above the obstruction, causing dyspnœa by pressing upon the trachea. Sometimes it is violently ejected, as if by vomiting. That the ejecta are not from the stomach may be demonstrated by their alkaline reaction. Regurgitation of food may take place immediately after swallowing, especially when the stricture is high up.

Diagnosis.—The diagnosis of œsophageal stenosis is made by the presence of the symptoms above described in association with the physical signs of that condition. Auscultation reveals normal deglutition sounds above the seat of obstruction. Below that point there are heard a variety of noises, for the most part of a gurgling and trickling character, persisting for a long time after the attempt to swallow is made. The use of the sound demonstrates more accurately the situation of the stricture, and the extent to which the calibre of the œsophagus is obstructed. Before using that instrument it is important to negative the existence of a thoracic aneurism, which may have produced the obstruction by encroachment on the œsophageal walls. The differentiation of cicatricial stricture from compression from without, as by tumors, enlarged glands, etc., is usually not difficult, because in the former case we have a clearly defined history, and in the latter, the presence of unmistakable phenomena to guide us.

Prognosis.—Stricture of the œsophagus is always a serious matter, many of the cases ending fatally. While it is generally possible to secure some benefit from dilatation, the gain is very frequently lost by subsequent recontraction. In some cases the obstruction appears to have been the result of inflammatory infiltration of the œsophageal walls judging from the permanence of the results. The introduction of the sound stimulates absorption of the inflammatory exudation.

Treatment.—The treatment of stricture of the œsophagus is purely

mechanical, and consists of dilatation by the introduction of bougies of larger and larger calibres. The treatment must be persevered in for a long time because of the liability to relapses. When the obstruction is due to cancerous growths in the œsophageal wall or to compression of tumors from without, dilatation must not be employed. Electrolysis may be practised for the cure of otherwise irremediable strictures. It is impossible as yet to say what results may be obtained from it, or to what dangers it may subject the patient. It must be employed skillfully or not at all.

DILATATION OF THE ŒSOPHAGUS.

Definition.—A circumscribed or diffuse enlargement of the lumen of the œsophagus.

Varieties.—Dilatation of the œsophagus is described as primary or secondary. The former variety occurs without apparent cause; the secondary form results from stricture of the œsophagus at a point below the dilatation.

Dilatations are fusiform, spindle-shaped, or sacculated. A variety dependent upon traction upon the œsophageal walls from without, has also been described and is known as traction diverticula.

PRIMARY DILATATIONS.

Primary dilatations of the œsophagus are fusiform or cylindrical in shape. They may involve the tube throughout its entire length, or they may be limited, nearly always the former, however. They usually involve the entire circumference of the œsophagus; exceptionally, they affect but one side. Their favorite situation is in the middle of the thoracic portion of the tube, because it is at this point that the structure receives the least support from surrounding tissues.

Etiology.—The cause of primary dilatation of the œsophagus is obscure. It is generally stated, however, that it arises from a weakness of the walls of the tube, this feebleness of structure usually being congenital. There is no positive proof of the truth of this latter assertion. As a matter of fact it has been noted that the symptoms are first manifested in early life, generally at about the fifteenth year. Among exciting causes have been mentioned traumatism, as from an external blow, or the lodgment of a foreign body in the œsophagus. As a predisposing cause in some cases, gout has been mentioned.

Symptomatology.—The characteristic symptom of dilatation of the œsophagus is the regurgitation of food entirely unchanged in character, hours after it has been swallowed. The regurgitated matters are alkaline in reaction. When the composition of the food is starchy, the regurgitated matters have a sweetish taste owing to the diastasic action of the saliva, with which they have been commingled, upon the hydrated

starch. The patient experiences more or less difficulty in deglutition. The food retained in the dilated œsophagus undergoes decomposition, this condition showing itself by fœtor of the breath. The accumulation of food may give rise to some local symptoms, including a sense of distention, local heat and burning, and various phenomena arising from the pressure of the food mass on neighboring organs. Thus the heart's functions have been disturbed, giving rise to the mistaken idea that that organ is really at fault, or suggesting the possible presence of aneurism. Emaciation is rarely marked, because as a rule sufficient food passes into the stomach to maintain a fair standard of nutrition.

The œsophageal sound may or may not be readily passed. This depends upon whether or not the œsophagus has been doubled upon itself. In some cases that structure is greatly lengthened; in one case it was forty-six centimetres in length. The dilated tube may attain a circumference of thirty centimetres.

SACCULATED DILATATION.

Sacculated dilatations occur in the majority of cases in the posterior wall of the œsophagus at its junction with the pharynx, because of a congenital weakness of the structures at this point. The dilatation is favored by the mechanical action of portions of food. A dilatation having been started it is readily aggravated by a succession of mechanical influences. The sacculations range in size from a slight bulging to a sac of five inches in length.

Etiology.—As exciting causes in individual cases there have been observed traumatisms, as from throttling, the impaction of a fishbone, the wearing of too tight a collar, etc.

Symptomatology.—In slight cases the symptoms are by no means as prominent as those of the variety above described. Indeed, in many cases they are entirely absent. The capacity of the dilatation is small, as a rule, consequently the fragments of food retained and afterwards expelled are small and few. The situation of the pouch is such, however, that it may be visible externally on one or both sides of the larynx. As to examination with the sound, that instrument may be passed readily one day and with only the greatest difficulty on the next. These differences have found an explanation in the varying degrees of emptiness and fulness of the sac. It has been claimed that in some cases auscultation of the sac will at times discover a splashing sound.

TRACTION DIVERTICULA.

This form of dilatation is more common than either of those already described. They are produced by some condition originating outside of the œsophagus causing traction upon its walls, and thus producing

cone-shaped diverticula. They are usually found on the anterior wall of the tube at about the level of the bifurcation of the trachea. They are believed to originate, in the majority of cases, in scrofulous disease of the lymphatic glands in this situation. In some cases they have been produced by vertebral caries. They range in depth from two to twelve millimetres, give rise to no symptoms, and are often recognizable by the œsophagoscope.

SECONDARY DILATATIONS.

The mechanism and pathology of this variety of dilatation is self-evident. It results from stenosis of the œsophagus at a lower level than the dilatation. The history of the case generally makes it possible to determine the nature of the causative obstruction, while the existence of the latter is made evident by the use of the sound.

Prognosis of Œsophageal Dilatation.—This is unfavorable, as the causes are generally irremediable, and there is no treatment which can be directed to the cure of the dilatation.

Treatment.—There is no satisfactory treatment for any of these cases. The victims will sometimes devise a suitable method in their individual cases by which food may be made to pass onward to the stomach, or the sac can be emptied. The whole subject of treatment may be summed up in means for the maintenance of nutrition and cleanliness of the sac.

CANCER OF THE ŒSOPHAGUS.

Etiology.—Cancer, although the most frequently observed disease of the œsophagus, is comparatively rare, for out of 8,289 deaths from malignant disease, according to Walshe, but 13 were cancer of the œsophagus. Cancer in this situation is nearly always primary. Heredity and age seem to exert about the same influence as in cancer elsewhere. Men are more frequently attacked than women. The abuse of alcohol has been assigned as a cause. The probable fact is that alcoholic excesses tend to chronic hyperæmia of the œsophagus, and so to localization of malignant disease in this situation. Indigestion and cicatricial stenosis are said to exert a similar influence.

Pathology and Morbid Anatomy.—Concerning the most frequent situation of cancer of the œsophagus there seems to be a difference of opinion. Mackenzie, Habershon, and Butlin state that it is in the upper third; while Pepper, Petri, and Zenker, consider the lower third to be most frequently attacked, and my own experience coincides with this. The reasonable conclusion drawn from these diverse observations is that the disease has no favorite location. In the majority of cases the tumor is epitheliomatous, beginning in the mucous membrane and soon spreading to the other structures of the œsophagus. It may encircle the

tube, break down, and ulcerate. It rarely extends further than four inches along the long axis of the œsophagus. It may spread to contiguous structures, or may be followed by secondary growths in other portions of the body. By reason of the ulceration perforation sometimes takes place either into the air passages or into the peri-œsophageal tissues. In the latter case abscess forms.

Symptomatology.—The initial symptoms of œsophageal cancer are practically identical with those of stenosis, namely, gradually increasing dysphagia, experienced first as to solids, and later to both liquids and solids. In some few cases this symptom is absent. In others, after existing for a long time, sloughing of a portion of the growth takes place, the lumen of the canal is restored and the dysphagia disappears. Next to the dysphagia the cachexia appears, which so frequently accompanies malignant disease in any situation. Digestion is impaired early, vomiting is not infrequent and there is suffering from hunger. The pressure of the tumor on the trachea sometimes gives rise to dyspnœa. Auscultation of the œsophagus reveals the situation and degree of the stenosis. Emaciation and debility usually progress rapidly. Death as a rule results from asthenia; sometimes, however, it follows perforation of the air passages or the peri-œsophageal tissues. The tumor may press upon the recurrent laryngeal nerve with resulting aphonia.

Diagnosis.—Cancer of the œsophagus is to be differentiated from simple stenosis, spasmodic stricture, syphilitic disease, simple dilatation and cancer of the stomach. The history of the case affords an all-sufficient means for distinguishing simple stenosis. In spasmodic stricture the obstruction is of sudden onset and occurs most frequently in hysterical women. There is no pain, and the sound can be passed readily when the patient is anæsthetized. In paralysis of the œsophagus the passage of the sound is readily effected. Syphilitic disease may present so close a similarity to cancer as to make a differentiation impossible. Even the possession of a syphilitic history does not clear up doubts, as syphilitic subjects may have cancer. The therapeutic test is often the crucial one for diagnosis. The symptoms of dilatation are distinctive, viz., the regurgitation of unchanged food and freedom from pain.

Prognosis.—The prognosis of cancer of the œsophagus is most unfavorable, death resulting in most instances in less than one year after the appearance of symptoms.

Treatment.—This is very unsatisfactory. While the œsophagus is pervious the patient should be fed on highly nourishing liquid food, *e. g.*, milk, broths, etc. After that time the question of dilatation and other operative interference comes up. Under such circumstances the question as to the proper course should be left to a surgeon of judgment and experience.

RUPTURE OF THE ŒSOPHAGUS.

Etiology.—While the possibility of rupture of the œsophagus with perfectly healthy walls has been denied, a few cases occurring under such circumstances have been reported. Usually this accident has happened as the result of violent and sudden vomiting in persons whose tissues have become weakened by softening. The vomiting producing the rupture is necessarily violent, the mechanical action of the ejected matters being intensified by some obstruction to their free escape. The nature of this obstruction is not always clear; in some cases it has been suggested that it is due to contraction of the circular fibres of the œsophagus in its upper portion. The amount of force required to produce a rupture of this tube has been determined by experiment as ranging from twelve and a-half to five and three-quarter pounds. The patients are for the most part men addicted to free use of alcoholic liquors and accustomed to heavy eating. The suggestion has been offered that the œsophagus has been softened by the action of the gastric juice, but practical observations do not confirm this theory. The rupture in nearly every instance is situated at the lower end of the tube, and its edges are as cleanly cut as if made with a knife.

Symptomatology.—The accident usually happens during the state of intoxication or after partaking of a heavy meal, and is excited by a violent paroxysm of vomiting. The patient experiences a sensation as if something had given way internally, which is followed at once by severe pain and collapse. The pain is referred to the epigastrium or along the course of the œsophagus. It is nearly always accompanied by subcutaneous emphysema, which shows itself at first in the parts at the root of the neck anteriorly. Following the rupture, the ability to vomit is often lost.

Diagnosis.—Notwithstanding the prominence of the symptoms, this affection has never been diagnosticated during life. It can only be suspected when in the presence of the above symptoms there is a history of previous œsophageal disease, with expectoration of blood and inability to vomit. Physical examination may give evidence of escape of air and fluid into the pleural cavities.

Prognosis.—No case of recovery from the accident has been reported. Death takes place very rapidly, although in one case it did not occur until the lapse of eight days.

Treatment.—The treatment suggested hitherto has consisted of the introduction of the œsophageal tube, which is permitted to remain *in situ*, and through which feeding may be conducted; or, the administration of all food and medicine per rectum. As for the rest, the therapeutic measures must be based upon indications as they arise.

ŒSOPHAGOMALACIA.

Very little, if anything, is known concerning œsophagomalacia as an actual clinical condition. It is believed by those with the most experience that it is a purely post-mortem lesion in all cases, dependent upon the action of the gastric juice on the walls of the œsophagus. It seems to occur with the greatest frequency in patients who have died of some disease of the brain, and it is asserted that the disintegrating action of the gastric juice on the tissues begins during the moribund condition. The portion of the tube affected is the lower segment and the posterior wall. It is hardly likely that this condition is capable of recognition even should it occur during life.

NEUROSES OF THE ŒSOPHAGUS.

The neuroses of the œsophagus of especial interest are paralysis and spasm.

PARALYSIS OF THE ŒSOPHAGUS.

Etiology.—Paralysis of the œsophagus is a rare event from any cause. It may arise, however, from quite a variety of nervous lesions, the most frequently encountered of which is post-diphtheritic neuritis. It is one of the manifestations of disease of the medulla, and occurs in conjunction with bulbar paralysis, locomotor ataxia, disseminated sclerosis and syphilitic disease. As a result of nerve pressure it must be very rare, for it can only occur when both pneumogastrics are involved. It is very doubtful if it is ever a hysterical phenomenon. In cases of approaching dissolution, from a variety of causes, it is sometimes present.

A weakness of the œsophagus producing difficult deglutition occurs in old age and in persons with broken-down constitutions; but the lesion in such instances is probably myopathic rather than neuropathic.

Symptomatology.—Paralysis of the œsophagus gives rise to difficulty in swallowing without any evidence of obstruction indicated by the readiness with which the sound may be passed. The passage of the instrument, moreover, does not give rise to the same degree of nausea and vomiting as in health. Auscultation shows the normal deglutition sounds to be absent and replaced by the sound of fluid going down drop by drop. Associated symptoms are nearly always present and vary according to the etiological factors at work in each case.

Prognosis.—In the majority of cases, especially in those dependent upon organic central disease, the prognosis is absolutely unfavorable. Post-diphtheritic paralysis is always a serious matter, yet a respectable portion of these cases recover. In general terms the prognosis may be said to be that of the primary disorder.

Treatment.—This consists in the maintenance of nutrition by rectal alimentation or feeding through the œsophageal tube, or both; stimulation of the paralyzed œsophagus by faradization, and the internal administration of *nitrate of silver*, *gelsemium*, *plumbum*, or *strychnia* as suggested by the symptoms.

SPASM OF THE ŒSOPHAGUS.

Synonyms.—Spasmodic stricture of the œsophagus; œsophagismus.

Etiology.—Speaking pathologically, spasm of the œsophagus is the result of spastic contraction of the circular muscular fibres of that structure through a limited portion or the whole of its length. It occurs for the most part in female subjects between eighteen and thirty years of age, but is not uncommon later in life, and has been observed in childhood. Its victims are nearly always neurotic, often so by heredity. When men are affected, examination discloses that they are emotional or hypochondriacal in temperament.

Œsophageal spasm sometimes occurs as a symptom of various nervous disorders, such as hydrophobia, chorea, and epilepsy. In the first named it is always an important symptom. It is rarely present in chorea. Occurring in epilepsy, it forms part of the general convulsive seizures. A most interesting form of œsophagismus is that constituting spurious hydrophobia, in which it results from psychical causes in persons who have been bitten by dogs and stand in mortal fear of rabies. In some such cases a fatal result has followed.

Sometimes the spasm is a reflex symptom, the irritation giving rise to it existing in the larynx or in a distant portion of the body. It has occurred in association with uterine disease, and has disappeared on the cure of that disorder. A few cases have been reported in which it was a symptom of pregnancy. Gastro-intestinal irritation has produced some cases, the primary trouble being cancer of the stomach or tapeworm.

It is sometimes produced by organic diseases of the œsophagus.

Brinton directed attention to the comparatively frequent association of œsophagismus with gout. He argued that the acid condition of the blood caused spasm of the œsophagus just as it did cramps in the legs, numbness of the extremities, etc. Mackenzie looks upon the spasm in these gouty cases as the result of irritation of the œsophagus by acid eructations.

Symptomatology.—Attacks of œsophagismus are of sudden onset. The patient discovers inability to swallow, the dysphagia being associated with a marked sense of constriction of the throat and chest, palpitation, hiccough and even convulsions, the latter usually being of the hysteroid type. In mild cases or those of short duration, the diffi-

culty in swallowing refers more to liquids than to solids; later, the most difficulty is encountered in swallowing solids. The attacks are paroxysmal. Food is very often regurgitated, being expelled forcibly and immediately after the attempt at swallowing is made, which gives a very important point for differentiation from organic stricture, in which expulsion is not forcible and does not take place immediately after swallowing. The general nutrition of the patient is well preserved notwithstanding the violence of the symptoms.

Physical examination by the bougie and auscultation show that the seat of obstruction is not always the same. Auscultation discovers far less bubbling and dropping than in organic stricture. While the bougie meets with an impediment on first introduction, the obstruction usually gives way under slight continued pressure. In doubtful cases the introduction of the sound under anæsthesia dispels all doubt, for in spasm complete relaxation ensues.

Diagnosis.—The diagnosis is based on the suddenness of the attacks, the association with numerous nervous symptoms, and the varying position of the obstruction as shown by physical examination.

Prognosis.—This is nearly always favorable, although some cases resist treatment for years. Some few cases resulting from the fear of hydrophobia have resulted fatally.

Treatment.—In many instances the only treatment required is that suited to hysterical affections in general. In others it is necessary to remove some source of reflex irritation, and in still others some associated disease must be cured. Gouty cases require medication and diet and hygienic precautions adapted to the cure of that condition. Sometimes the introduction of the œsophageal bougie proves curative. More frequently, however, the sound must be introduced repeatedly before relief is secured. Feeding, in the presence of a determined nurse, will often work wonders. As to remedies, those useful in neurotic affections generally are indicated, viz., *ignatia*, *cimicifuga*, *tarentula*, *belladonna*, *cantharis*, *gelsemium*, *agaricine*, *hyoscyamus* and *arsenic*.

AFFECTIONS OF THE STOMACH.

GENERAL CONSIDERATIONS RELATING TO DISEASES OF THE STOMACH.

Physical Examination.—The investigation of diseases of the stomach by inspection, palpation, percussion and auscultation, requires accurate ideas concerning the size and position of this organ. The stomach lies in the upper portion of the abdominal cavity, occupying the epigastric and left hypochondriac regions. It is situated almost entirely to the left of the median line, but one-sixth of the organ, according to Vierordt, and one-fourth, according to Pepper, being found on the right side. Immediately above, it is in relation with the diaphragm and the liver; below it lies the transverse colon, to the left is the spleen; behind are the great vessels, the crura of the diaphragm, the pancreas, and the left kidney; to the right the liver, and in front it is in direct contact with the abdominal walls, the liver and the diaphragm.

The cardiac orifice occupies a fixed position, being practically the same whether the organ is distended or empty. It lies immediately behind the cartilage of the seventh left rib, about one and a quarter inches from the edge of the sternum. It is covered by the liver. The position of the pyloric orifice varies greatly, according to the condition of the organ, *i. e.*, whether or not it is distended. It is generally stated as situated at a point near the end of the right eighth costal cartilage, and on a vertical line let fall from the right edge of the sternum. Considered posteriorly, the cardiac orifice is on a level with the spinous process of the ninth dorsal vertebra; and the pyloric orifice with that of the eleventh. The pylorus lies posteriorly, being rather deeply situated, and is covered by the left lobe of the liver. The axis of the stomach is nearly vertical, extending from above downward, and from left to right. Its lesser curvature is directed posteriorly and to the right; its greater curvature looks forward, and when the organ is distended comes in direct contact with the abdominal walls. The uppermost portion of the fundus of the organ reaches to the level of the fifth rib, and the lowermost portion, when the stomach is distended, nearly to the umbilicus. In all examinations of the stomach it must be remembered that so much of the organ is covered by the diaphragm, liver, spleen, the left lung, and the

heart, that but a comparatively small portion of it comes into direct relation with the abdominal wall.

Inspection.—Inspection is of limited value in gastric diseases. By it we may recognize the presence of more than ordinary distention, abnormal activity of the peristaltic movements, and the state of the abdominal walls. Flatulent distention is sometimes sufficient to obliterate the usual depression at the end of the sternum. When there is obstruction at the pylorus, the movements of the stomach are sometimes exaggerated in their efforts to overcome the same, and are plainly visible through the abdominal walls in emaciated subjects. These excessive muscular contractions are frequently observed as the result of purely nervous influences.

Palpation.—This enables us to determine the presence or absence and the general characteristics of tumors.

Percussion.—For the performance of percussion the patient should be placed on his back with his limbs well drawn up and the abdominal walls relaxed as thoroughly as possible. The investigation should be begun above, *i. e.*, over the thoracic organs and along the mammary line, and proceed downward towards the stomach. In this way the upper limit of gastric tympanitic resonance is determined. To locate the lower border of the stomach, percussion is practised in the opposite direction, the investigation being started below and continued upward. Practice will soon demonstrate that there is a distinct difference between the tympanitic resonance of the intestines and that of the stomach, so that one can decide where one ends and the other begins. The quality of the tone of the gastric tympanitic resonance will be sufficient for an experienced observer to give information as to the capacity and degree of distention of the stomach.

By percussion we are enabled to determine the outlines of the stomach, and sometimes the presence or absence of tumors.

Succussion.—Succussion as applied to the stomach is of two kinds, digital and total, the latter also being known as hippocratic succussion. To perform digital succussion the patient is placed on his back with the abdomen bared and its muscles thoroughly relaxed. The operator then performs a series of rapid taps with the ends of his fingers along a line running from the umbilicus to the edge of the false ribs on the left side. Hippocratic succussion is performed by shaking the patient while the ear or the stethoscope is applied over the stomach. Mathieu and other authorities look upon this as the more reliable of the two methods. The detection of a splashing sound in the stomach shows that the organ is not empty. When this occurs at a long interval after eating it shows that a certain amount of the food taken remains stagnant. Care must always be taken to discriminate between sounds in the stomach and those in the transverse colon.

In doubtful cases it has been suggested that the examination of the stomach by inspection, palpation, percussion, etc., be facilitated by distending the organ by fluids or gases. Of the latter, air and carbonic acid have been employed. Ziemssen recommends the ingestion, one immediately after the other, of solutions containing respectively seven grammes of bicarbonate of soda and six grammes of tartaric acid. In the case of women, he advises one gramme less of each. The carbonic acid thus generated undoubtedly distends the stomach, but it may in so doing produce quite serious symptoms from the pressure exerted. In such an event the confined gas should be liberated at once by inserting a stomach tube. The stomach may also be distended by the introduction of air through a stomach tube by means of a suitable pump. This method has the advantage of regulating the quantity of air introduced and providing for its instant escape should it occasion any serious discomfort.

The large intestine may be distended in a similar way. Preliminary to the operation, the bowels should be emptied by a copious enema. Some prefer carbonic acid gas for intestinal use, as it is irritating to the mucous membrane and so causes closure of the ileo-cæcal valve and prevents the escape of the gas into the small intestine.

It has been recommended that the colon be distended with water in order that its outlines may be determined; and still others have recommended that the stomach be distended with gas and the colon with water.

Auscultation.—By auscultation the existence of obstruction at the cardiac orifice may be determined. Listening with the stethoscope over the œsophagus there is first heard a spurting sound, followed after several seconds by a splashing as the fluid escapes into the stomach.

Auscultation also enables us to determine the lowermost limits at which splashing sounds are heard. In health this should never be below the umbilicus.

Bimanual Examination.—A method of determining the size of the stomach by what may for convenience be called bi-manual palpation has been proposed. While useful to a certain extent, it is attended by certain dangers which greatly lessen its utility. A sound is passed into the stomach and is made to touch various portions of its walls, while the free hand palpates the abdomen and recognizes the position of the sound as it is changed.

Examination of the Contents of the Stomach.—The following is the method of procedure when a chemical examination of the contents of the stomach is desirable: (1) the patient is given a test meal. (2) At a stated period following this the contents of the stomach are removed through a stomach tube by expression or aspiration. (3) The removed matters are tested for the presence of free hydrochloric acid, lactic acid,

butyric acid, acetic acid, pepsin, pepsinogen, rennet, and the extent to which digestion has been carried.

The Test Meal.—The best test meal, because it is the simplest, is Ewald's test breakfast. This consists of a roll of bread, a glass of water, or a cup of tea without milk or sugar, taken on an empty stomach. This is sufficiently softened in a short space of time to enable it to be passed through the tube. At the end of one hour digestion is at its height.

To Remove the Contents of the Stomach.—A soft rubber stomach tube is passed according to the directions to be given shortly. Sometimes this provokes sufficient retching to cause the escape of the ingesta in sufficient quantities to satisfy the requirements of the experiment. If not, the patient is told to cough, the act being as far as possible with the diaphragm. This suffices to fill the tube, when the contents of the stomach flow out on the principle of siphonage. The quantity removed should not exceed forty centimetres under normal conditions.

Should the expression method fail, the contents may be aspirated by means of a rubber bulb or aspiration apparatus attached to the stomach tube.

Einhorn's stomach bucket is a very convenient instrument for obtaining small quantities of gastric contents for qualitative analysis. It consists of a hollow receptacle securely attached to a cord. This is swallowed, and immediately after its introduction into the stomach it becomes filled with gastric contents. It may then be withdrawn without the slighest trouble. To some persons this instrument is less objectionable than the tube, the string causing little or no inconvenience in the pharynx or œsophagus.

The next step in the examination is the filtration of the gastric contents.

The reaction of the filtrate is now to be tested by either litmus, congo or tropœolin ōō paper, which in the presence of acid changes to red, blue or purple, respectively.

To Determine the Total Acidity there are needed a deci-normal solution of caustic soda (four parts to the thousand), phenolthallein, a graduated burette, a burette holder, and a test-tube. To ten cubic centimetres of the filtered gastric contents are added a few drops of a weak solution of phenolthallein. The soda solution is placed in the burette, from which it is permitted to drop into the fluid under test, until the acidity of the latter is neutralized. This point is reached when there develops a persistent faint red color. The total acidity may now be calculated; each cubic centimetre of soda solution used corresponds to 3.65 milligrammes of hydrochloric acid.

To Determine the Presence of Free Hydrochloric Acid, Gunzburg's reagent is required. This is prepared as follows: Vanillin, one

part; phloroglucin, two parts; alcohol, thirty parts. This solution is damaged by light; hence it should be kept in a dark glass bottle. To use it, one drop is placed in a porcelain capsule, with a drop of the gastric fluid, then gently evaporated over an alcoholic flame. If free hydrochloric acid is present a red hue is formed along the line of evaporation.

In some cases in which the hydrochloric acid is mixed with peptones no reaction is obtainable. Under such circumstances Slosse separates the hydrochloric acid by plunging strips of Swedish filter paper into the mixture. At the end of an hour a piece of the paper thus saturated is placed in a capsule with a few drops of Gunzburg's reagent. Heat is then applied gently and the reaction above mentioned is obtained.

Mathieu announces his preference for ethyl-green as a very available test for hydrochloric acid. A half-teaspoonful of this dye is dissolved in about a litre of water, making a blue solution. The reaction of this substance with hydrochloric acid varies according to the quantity of the latter present. When present in small quantities, a grass-green color is obtained; when in the proportion of one and a half to two parts per thousand, a yellowish green; and when from two and a half to three parts per thousand, the color of dead leaves. The reagent thus treated with hydrochloric acid solutions shows the property of decolorizing, the rapidity of the decoloration being in direct proportion to the amount of hydrochloric acid present.

For Determination of the Actual Quantity of Hydrochloric Acid Present, the method of Mintz is the most popular. Ten cubic centimetres of the filtrate are taken and well shaken with one hundred cubic centimetres of ether. The latter takes up the organic acids and is readily separated from the rest of the fluid. It is then placed in a test-tube, and to it is added, drop by drop, from a burette, a deci-normal solution of soda. The point of neutralization is recognized when the gastric filtrate fails to develop a blue color when added to a solution of congo red. The number of cubic centimetres of soda solution should be multiplied by .00365, and again by 10, which will give the percentage of free hydrochloric acid. This should be normally 0.14 to 0.25 per cent.

Hydrochloric acid is nearly always absent in cancer of the stomach and other diseases seriously impairing the functions of the mucous membrane of that organ; an increase is found in ulcer and the neuroses.

To Determine the Presence of Lactic Acid, Uffelmann's reagent is the best. This is prepared as follows: One drop of pure carbolic acid is added to five drops of a dilute solution of neutral ferric chloride. Water is then added until the preparation is of an amethyst-blue color. A small proportion of lactic acid added to this reagent produces a light-

yellow color. The same reaction may be obtained by sugar, alcohol, and the phosphates. Any source of error may be eliminated by shaking ten cubic centimetres of the filtrate with several portions of ether; removing the latter and evaporating it to dryness. A watery solution should be made of the residue, which is then tested for lactic acid. Lactic acid is pathological if found more than an hour after a meal.

The Presence of Butyric Acid is determinded by Uffelmann's reagent, with which it strikes a brownish-yellow color.

The Test for Acetic Acid is a little more complicated. An ethereal extract of the gastric contents is prepared and carefully evaporated over a water-bath. The residue is then dissolved in water and neutralized with neutral ferric chloride solution. If acetic acid is present a blood-red color is produced.

The Test for Pepsin.—Pepsin may be assumed to be present when the tests already described show that hydrochloric acid is present. The existence of pepsin is to be determined by artificial digestion. A small piece of hard-boiled white of egg is placed in a test-tube with a few centimetres of filtered gastric juice and maintained at a temperature of 100° F. for several hours. If pepsin is present the albumin will be dissolved within a few hours.

Test for Rennet.—Ordinarily this is not a matter of much practical importance. To ten cubic centimetres of raw milk are to be added from two to five drops of the gastric filtrate, and the whole subjected to a temperature of about 100° F. If rennet is present, curdling will take place in the course of fifteen minutes.

Test for Starches.—Ordinarily, starches taken with the food should be digested in about one hour. If still present when the gastric contents are removed, they may be detected by Lugol's solution of iodine. If starch is present a blue reaction is obtained; if erythrodextrin, a purple. If starch is absent the iodine undergoes no change in color.

Test for Peptones.—To a small portion of the filtrate add a small amount of caustic soda or potash, and some dilute cupric sulphate. If peptones are present a purplish-red reaction ensues.

Test for Rennet Zymogen.—A portion of the gastric filtrate is first rendered alkaline with soda solution. Two or three cubic centimetres of a one-per-cent. solution of chloride of lime are then added. Mixing this with an equal quantity of milk and subjecting it to the same conditions as in the test for rennet, curdling will take place in the course of fifteen minutes if zymogen be present.

To Determine the Exact Quantity of Fluid Contained in the Stomach.—Withdraw a certain quantity of the gastric contents, and determine its acidity. Dilute a portion with a definite quantity of water and pour it back into the stomach. Again withdraw the gastric contents and again determine the acidity of this portion. The total

quantity of fluid contained in the stomach may be calculated by the following formula:

$$x = b + \frac{a' q}{a - a'}$$

in which x is the quantity of fluid contained in the stomach; b the quantity of undiluted gastric juice first withdrawn; a its acidity; a' the acidity of the diluted liquid; and q the quantity of distilled water added.

To Determine the Motor Power of the Stomach the salol test of Sievers and Ewald seems to be the most practical from a clinical standpoint, notwithstanding the objections urged against it. Fifteen grains of salol are given at a dose. While exposed to the acid contents of the stomach its composition remains unchanged. As soon, however, as it reaches the small intestine and is acted upon by the alkaline pancreatic juice it is broken up into salicylic acid and phenol, and salicyluric acid appears in the urine, where it is recognized by giving a purple reaction to a solution of neutral ferric chloride. Under normal conditions this should be obtained in from forty to sixty, and at the most, in seventy-five minutes.

Einhorn has invented a little instrument by which the movements of the stomach are registered on a moving strip of paper. While the apparatus shows considerable ingenuity in its construction, its practical value must be considered as yet undetermined.

To Determine the Rapidity of Absorption by the Mucous Membrane of the Stomach, fifteen grains of iodide of potassium are administered in a capsule, which, after filling, should be carefully wiped off. Normally, iodine reaction should be obtained in the saliva in fifteen minutes. This may be determined as follows: Filter paper is moistened with starch paste and dried. Then every five minutes a piece of this should be moistened with some of the saliva, and some fuming nitric acid added. If iodine be present, the characteristic blue reaction of iodide of starch will appear.

To Introduce the Stomach Tube and Perform Lavage, have the patient seated opposite the operator, with the head thrown backward slightly and gently supported. Lubricate the tube with water or milk (do not use oleaginous substances for this purpose); have the patient protrude the tongue. Pass the end of the tube over the dorsum of that organ, and when it reaches the pharynx direct the patient to swallow. At the same time the tube is pushed gently onward, the direction to the patient to keep on swallowing being kept up. Finally the end of the tube enters the stomach, indicated by the mark on the tube reaching the line of the teeth. We are now ready for lavage. Warm water—plain or mixed with artificial effervescent Vichy salts—is now

poured into the stomach through the tube, at the outer end of which is attached a funnel. When from a pint to a quart is thus introduced, and before the funnel is emptied, the outer end of the tube is lowered, when the water will flow out freely by siphonage.

When this operation is attempted on a patient for the first time, several minor difficulties will be encountered. One of these is the intolerance of the pharynx and stomach to a foreign body. The difficulty as to the former may be overcome by lessening the reflex excitability of its mucous membrane by a course of bromide of potassium. As a rule, also, a few applications of the tube soon habituate the pharynx to the presence of the foreign body. It is not unusual for the patient to become slightly asphyxiated, but this passes off in a very few minutes and need occasion no alarm. A few words of assurance to the patient are all that is necessary. Intolerance of the stomach is annoying because of the persistent vomiting during the operation. It is overcome by practice, though not as quickly as is that of the pharynx.

The stomach washing process should be continued at each sitting until the water returns from the stomach perfectly clear.

ACUTE GASTRITIS.

Synonyms.—Acute dyspepsia; acute gastric catarrh; simple gastritis.

Definition.—An acute inflammation of the mucous membrane of the stomach.

Etiology.—A certain amount of predisposition, congenital or acquired, seems to be necessary before an existing cause can produce an acute gastritis. The stomach is by nature a tolerant organ, ofttimes permitting the grossest violations of dietetic principles without resentment. Persistent carelessness in diet, and constitutional diseases, weaken its resisting power and pave the way for acute gastritis as for other diseases. Among the acute constitutional causes deserving of especial mention are tuberculosis, syphilis, gout and rheumatism. In the gouty and rheumatic cases the gastric symptoms are very liable to disappear as the joint lesions become manifest. Diseases of different organs leading to chronic congestion of the digestive tract, as disease of the heart, pulmonary emphysema, and cirrhosis of the liver, are also predisposing causes of acute gastric catarrh. Many patients, even the very young, are possessed of so-called delicate stomachs, and are attacked with acute gastric catarrh on very slight dietetic transgressions. Sometimes this condition appears to be hereditary. Occasionally it is found in gouty subjects. Of the exciting causes, overloading the stomach or the taking of indigestible food is the most prominent, and especially so when the food is insufficiently masticated. The ingestion of highly spiced or acid food is injurious. The exposure of the gastric mucous membrane to

extremes of heat and cold, as by the taking of very hot or very cold food, accounts for many cases. Some cases arise from eating tainted meat or fish, and these it must be remembered are very apt to be associated with relatively severe symptoms. Acute gastritis may be caused by agencies entirely outside of the digestive apparatus; thus a sudden emotion or prolonged nerve-wear causes a diminution in the supply of the gastric juice, indigestion follows, food remains too long in the stomach, decomposes and becomes a fertile source of irritation. Catching cold from wearing insufficient clothing sometimes produces acute gastric catarrh. Many cases follow closely on excessive indulgence in alcohol.

Pathology and Morbid Anatomy.—Acute gastric catarrh rarely ends fatally, consequently opportunities for its pathological study are seldom presented. That the changes are catarrhal is reasoned by analogy from the clinical phenomena of the disease. While the introduction of microbes into the stomach has been suggested as an important etiological factor, actual examinations have shown that, notwithstanding the presence of micro-organisms in the stomach contents, they are rarely, if ever, found in the gastric mucous membrane. The mechanical or chemical irritation of food probably explains nearly all cases. From Beaumont's observations we have learned that the mucous membrane becomes red, swollen, and even marked by small hæmorrhagic extravasations and superficial erosions, these being especially frequent near the pylorus. An excessive deposit of mucus is observed. The gastric juice is deficient in hydrochloric acid, while it is abundantly supplied with lactic and butyric acids. Microscropic examination shows the gastric tubules to be distended with large granular cells.

Symptomatology.—The variations in the clinical pictures presented by cases of acute gastric catarrh have led to classifications and differentiations of types. Practically we need recognize only the afebrile, the febrile and the erythematous. Considering first the afebrile variety, the onset of the disease is sometimes preceded by a feeling of weakness, then appear nausea, frequently vomiting and loss of appetite, which must be regarded as a very prominent symptom; thirst, heavily coated tongue, slight local pain, or heaviness and fulness in the epigastrium, sometimes slight epigastric tenderness, vertigo, headache, prostration and generally constipation, though the opposite condition—diarrhœa—sometimes obtains. The food taken tastes flat, and this leads to a craving for highly seasoned articles, which, of course, are injurious. The pulse is usually small and rapid, although it may remain unaffected. The face is often pale and the extremities cold. The vomited matters consist of food and mucus, and later of mucus and bile. Herpetic vesicles appear on the lips in many cases, especially during convalescence. The urine is sometimes high-colored and loaded with urates. The symptoms may indicate extension of the inflammatory process to adjacent portions of the diges-

tive tube; thus from duodenal catarrh there ensues jaundice, and from further intestinal complications, colic, and production of offensive flatus.

The *febrile* cases differ from the afebrile in the greater intensity of the symptoms and the presence of pyrexia, the temperature sometimes reaching as high as 103° to 104° F.

In the *erythematous* variety, the catarrhal element seems to be not at all marked. It is very apt to accompany the exanthematous fevers. There is a feeling of rawness in the œsophagus and stomach. The vomited matters contain but little mucus. The tongue is at first red and injected, later it becomes dry and glazed. The pulse is far more frequent than the the severity of the associated symptoms would seem to warrant.

Diagnosis.—The diagnosis of ordinary afebrile gastric catarrh presents no difficulty. With the febrile cases it is different, as these at times present a most confusing resemblance to typhoid fever, while in other instances they are but the early manifestations of one of the acute infectious diseases. Febrile gastric catarrh differs from typhoid fever in presenting a more rapid initial rise of temperature and less marked remissions. Typhoid fever, moreover, is characterized by rose-colored spots on the abdomen and an enlarged spleen.

Prognosis.—Acute gastric catarrh offers a favorable prognosis, nearly all cases improving in from three to five days.

Treatment.—When an attack has been provoked by injudicious feeding, the early vomiting must be regarded as a conservative process —nature's means of ridding the stomach of the offending article. It is a symptom to which no special treatment should be directed so long as it remains within reasonable bounds. Some patients, no matter how severely nauseated they may become do not vomit, and in some such it is advisable to rid the stomach of the irritating body by a mild emetic. In the majority of instances the offending substance has been ejected or passed on to the intestines by the time the physician is called. Sometimes, however, it is of such a nature as to remain in the stomach for an almost indefinite period, as instanced in cases in which milk has formed a large solid, indigestible coagulum in the stomach. As to the selection of an emetic, warm water will often suffice. Some physicians prefer the hypodermic administration of apomorphia in one dose of one-twelfth of a grain. When vomiting is so persistent as to become a source of great discomfort, it may be alleviated by the administration of small lumps of ice in some cases and the drinking of hot water in others. In the majority it disappears spontaneously as soon as the offending article has been ejected. When constipation is present the intestines should be relieved either by a full enema or a glycerin suppository. These failing, Hunyadi Janos water may be administered. The diet should be as light as possible. Indeed, it may be advisable to give little or no food for twenty-four to thirty-six hours. The best nutriment will be milk

diluted with an equal quantity of Vichy or soda water. In less severe cases milk, milk toast, gruels and beef soups in small quantities are allowable. When prostration is great, alcoholics may be administered, and only then. The more complete the rest given the stomach the more rapid will be the recovery. Vomiting sometimes persists from sheer exhaustion, in which case it must be treated by stimulants. In erythematous gastritis warm applications, as poultices to the epigastrium, are valuable.

The principal remedies are *nux vomica*, *bryonia*, *pulsatilla*, *ipecacuanha*, *arsenicum* and *antimonium crudum*. *Nux vomica* is adapted to the cases arising from overloading of the stomach, excesses in alcohol and pernicious drugs, and emotional influences. The patient is constipated; the tongue is heavily coated; the symptoms present a characteristic aggravation in the morning. *Bryonia* is likewise indicated in the cases arising from violent emotions. It is especially called for in cases occurring during the hot summer months as a result of indulgence in ice-cold drinks. The tongue is coated white; there is a putrid taste in the mouth; a sensation of a heavy load in the epigastrium is complained of, and either constipation or diarrhœa may be present. *Antimonium crudum* and *ipecac.* are useful remedies when vomiting is a prominent symptom; the former when the tongue is heavily coated; the latter when that organ is clean. Both *pulsatilla* and *ipecac.* are adapted to cases caused by indulgence in pastry; the former also when from fatty foods. The pulsatilla patient has little or no thirst; the mouth is dry and there is apt to be a putrid taste, especially in the morning. A feeling of weight in the epigastrium is often experienced; waterbrash is a common symptom. Cases arising from exposure to wet and cold also call for this remedy. *Arsenicum* is indicated by symptoms of more active irritation than those calling for any of the preceding remedies. Pain, thirst, restlessness and diarrhœa are the prominent phenomena. This remedy is a most effectual one, controlling many active cases. In my personal experience, *tartar emetic* has proven almost specific for gastric catarrh with much vomiting. Febrile cases require *aconite*, *bryonia*, *gelsemium* or *baptisia*.

ACUTE TOXIC GASTRITIS.

Acute toxic gastritis is a form of inflammation of the stomach following the ingestion of irritant poisons, notably arsenic, phosphorus, the mineral acids, the caustic alkalies, oxalic acid, carbolic acid, chlorate of potash, and corrosive sublimate.

Pathology and Morbid Anatomy.—Of necessity, the morbid changes vary according to the character of the toxic irritant, the quantity taken, and the period over which its ingestion was continued. Arsenic and corrosive sublimate produce a high degree of local irritation. The

former, alcohol and phosphorus, a fatty degeneration of the glandular epithelium, recovery from which is prolonged, notwithstanding the cause of the trouble has been removed; and the caustic alkalies and mineral acids, erosion and destruction of the gastric tissues.

Symptomatology.—The symptoms are of sudden onset, the most prominent one being vomiting, the ejected matters consisting, in addition to food, of bloody mucus and pure blood. Pain in the epigastrium is intense; collapse is imminent; the pulse is weak and thready. When one of the caustic alkalies or mineral acids has been taken, examination of the mouth and throat shows the local action of the chemical on these parts.

Treatment.—The first thing to do is to thoroughly empty the stomach, which should be done by the administration of one-tenth of a grain of apomorphia hypodermically. Some prefer washing out the stomach as more efficient. When a stomach tube is not available, ordinary rubber tubing will suffice. A glass bottle with the bottom broken off, and the neck inserted into the end of the tube will serve as a funnel. The tube should not be used, however, in the case of alkali or acid poisoning. In such cases neutralizing substances should be given in solution. In the case of acids, calcined magnesia in the proportion of three ounces to the pint of water; in the case of alkalies, one to five per cent. solutions of tartaric acid, lemon juice or vinegar. During the early days it may be imperatively necessary to give morphine hypodermatically to control the intense suffering. Ice may be applied to the epigastrium. Ice may also be sucked to quench the intense thirst. Water should be introduced by the rectum several times daily, and if not retained, resort may be had to hypodermoclysis. With improvement milk in some form should be first given. At this time the treatment is essentially that of ulceration of the stomach. Suggestions may be secured from the sections devoted to acute gastritis and ulcer of the stomach.

PHLEGMONOUS GASTRITIS.

Phlegmonous gastritis is an exceedingly rare suppurative inflammation of the submucous and muscular coats of the stomach, occurring either idiopathically or from metastasis. The idiopathic cases arise as the result of traumatism, alcoholic excesses, and dietetic errors. Bacterial infection may have occurred, but we have found no evidence of such. Metastatic cases arise secondarily to pyæmia, puerperal infection, and the exanthemata. The abscesses are generally small and often multiple. They sometimes terminate in perforation of the stomach. The course of the disease is exceedingly acute. Sometimes slight dyspeptic symptoms precede the violent outbreak, which is characterized by severe epigastric pain, great thirst, dry tongue, chills and high fever. Vomiting is fre-

quent and profuse, the vomited matters containing bile, mucus and pus. Finally sensorial disturbances appear, the patient becoming either comatose or wildly delirious. The recognition of the disease is a matter of considerable difficulty owing to the close resemblance of the symptoms to a localized peritonitis.

The **Prognosis** is exceedingly unfavorable, nearly all cases dying.

The **Treatment** should in general be conducted as for acute toxic gastritis, and as we know very little of its medicinal treatment, remedies can only be selected on symptomatic indications as they arise. I have had little experience with this rare form of gastritis, but that little has suggested *mercurius corrosivus* as one of the most important medicines. A careful review of the symptomatology will show that it possesses all the essential symptoms of this affection. *Carbolic acid* should prove of value. *Arsenicum, lachesis* and *chininum arsenicosum* are recommended.

MYCOTIC OR PARASITIC GASTRITIS.

Certain bacterial poisons may on rare occasions infect the gastric mucous membrane. Thus we have known of gastric diphtheria, infection with the fungus of favus universalis, and anthrax of the stomach. The symptoms produced present no features sufficiently characteristic to be denominated diagnostic.

CHRONIC CATARRHAL GASTRITIS.

Synonyms.—Chronic gastritis; chronic dyspepsia; chronic glandular gastritis.

Definition.—A chronic inflammation involving primarily the secreting structures of the stomach, resulting in excessive production of mucus and alterations in the composition of the gastric juice, the pathological changes eventually taking the form of glandular atrophy and weakening of the muscular structures of the stomach.

Etiology.—The causes of chronic gastric catarrh are found very largely in the eating habits of the individual, although predisposition is in many instances an important factor. The old saying that "a man's stomach is what he makes of it" expresses a great truth. Very many cases occur in persons endowed by nature with a strong, healthy stomach, who well knowing their capacity, persistently force it to its utmost, until much-abused nature rebels and a break-down occurs. The most important dietetic transgressions are rapid eating, insufficient mastication and salivation, excessive indulgence, drinking freely of iced drinks during the course of a hearty meal, and the use of improperly cooked food. Fried foods, and particularly sugar and starchy articles, are apt to be injurious. Excessive indulgence in pastry is no less so. The condition of the mouth is not sufficiently regarded as an important etiological factor of gastric catarrh. Sometimes the teeth are in such a

bad condition that proper mastication is impossible; in other cases the mouth is not cleansed with any regularity, contains much decomposing epithelium, mucus and food remnants and a variety of bacteria. The swallowing of these with the food must have a pernicious effect. In still other cases pyogenic diseases of the gums furnish irritating products, which may possess some influence.

Excessive indulgence in alcohol accounts for many cases of chronic gastritis. While the chewing of tobacco is productive of more harm than smoking, the latter, when carried to excess, is not infrequently injurious to the stomach.

The influence of disease in distant organs must be borne in mind. Thus disease of the heart, liver or spleen, and tuberculosis, maintain a chronic congestion of the gastric mucous membrane, leading ultimately to chronic catarrhal inflammation.

Changes in the blood itself, such as occur during the course of anæmia, typhoid fever, and many infectious diseases, pregnancy, gout, diabetes, and renal disease are not uncommon causes.

Pathology and Morbid Anatomy.—The mucous membrane of the stomach presents a yellowish or slatish-gray color, interspersed with reddish or brownish injected areas, and is covered with a thin layer of mucus. It is also thickened, in some places more than in others. All these changes are far more marked in the vicinity of the pylorus than in other portions of the organ. In severe cases the submucous tissues and even the muscular layer are hypertrophied.

Microscopically the pathological process is shown to have begun as glandular inflammation. Later, interstitial changes take place. The glandular alterations begin with congestion and dilatation of the blood-vessels, and in the milder examples of the disease do not advance any further, but if the lesion increases the glandular bodies become united together and to the adjoining coats. They then become distended with plugs composed of cells and granular matter, which project from their orifices. Sometimes the openings of the tubes are occluded with resulting formation of small cysts. In many cases the epithelium throughout the glandular structures undergoes various types of degeneration. The tissues between the glands undergo infiltration, followed by atrophy of the mucous membrane, which may be of two kinds. In both there is glandular destruction, but in one variety it is simple atrophy, accompanied by increase in the growth of connective tissue, the mucous membrane eventually appearing as a thin white superficial layer. In the other, called cirrhotic atrophy, the connective tissue overgrowth is very great, extending to both the submucous and muscular layers. The walls of the stomach undergo great thickening and the capacity of the organ is much reduced.

Atrophy of the gastric mucous membrane is thus a sequence of

long-continued gastric catarrh. This condition is one, however, which can only be positively said to exist when the parts are directly exposed to examination. Clinically it is not recognizable with certainty. Inasmuch as its chief phenomenon during life is the absence of gastric juice, Einhorn has suggested the designation achylia gastrica, a term worthy of general adoption.

Symptomatology.—The pathology of chronic gastric catarrh thus outlined explains the clinical phenomena of the disease. In the first place the local changes involve alterations in the blood supply to the gastric glands, this in turn influences the composition of the secretion of these glands with resulting disorder of digestion, and modification of the composition of the blood of the entire body. The activity of the digestive fluid is lessened, food is retained longer than normal within the stomach, undergoes decomposition, and acts as a local irritant. Mucus production becomes excessive, which by coating the food interferes, by mechanical action, with the direct influence of the gastric juice. The reaction of this mucus is alkaline, which counteracts the acid reaction of the gastric juice. In marked cases, the muscular coat of the stomach is impaired, and furnishes still another source of imperfect digestion.

In its early stages chronic gastritis is characterized by decided irregularity in its symptoms. Sometimes the exacerbations are so marked as to constitute veritable acute seizures; at others they amount merely to local and general discomfort, with intervening periods of comparative well-being. The initial symptoms are those of any disorder of digestion. The appetite is generally lost; or may be characterized by its fickleness. An absolute loathing of food is not unusual. Thirst is likewise variable. Occasionally it is marked; at one time, without thirst, the patient exhibits a disposition for large quantities of fluid during meals; or there is a sense of internal heat, relieved by drinking large quantities. The breath is often offensive. There is frequently a slimy sensation or disagreeable taste in the mouth, especially prominent in the morning. The tongue is generally more or less coated, especially at the base. The tip and edges are often red and glazed. The tongue may even be of a bright red color and have a raw appearance, the papillæ standing forth as bright red points. Aphthæ sometimes form on the tongue. The gums may be red, spongy and inclined to bleed upon a slight touch, and the mucous membrane of the pharynx, granular, inflamed and often secreting a tenacious mucus. The lips are often dry and cracked.

Local sensations in the epigastrium are very common, and range in character from a moderately severe pain to a sense of oppression or discomfort, often aggravated after the ingestion of food. The discomfort is not always felt as a pain, but is described by the patient as a feeling as

of a hard body lodged in the epigastrium. Tenderness on pressure is quite constant; often a vague discomfort becomes absolute pain when firm pressure is applied. The retention of food in the stomach leads to its decomposition and consequent eructation of gases, which may be odorless and tasteless or offensive and even putrid. Although vomiting is a frequent symptom, it is by no means a constant one. Examination of the ejected matters shows an excess of mucus, a diminution in the amount of hydrochloric acid and an excess of fatty and lactic acids. When the vomiting is very severe, the ejecta are mixed with bile. Sometimes there is only a simple eructation of food with the gas, which takes place mainly after eating. Many cases are associated with a more or less constant nausea, which is apt to be aggravated in the morning or shortly after meals. There should be no undue haste in declaring the presence of mucus in the ejecta, for it is well known that starchy foods in the stomach undergo change into a tenacious glutinous substance. Again, the sour taste of the vomited matters must not be made the foundation for the idea that hydrochloric acid is present in excess, for in very many cases this acidity is due to the acids of fermentation, lactic and butyric. In others it is the result of the irritating influence of the vomited matters upon the delicate œsophageal mucous membrane.

Sometimes there is only a simple eructation of food with the gas, which takes place mainly after eating. Many cases are associated with a more or less constant nausea, which is apt to be aggravated in the morning or shortly after meals.

The retention and decomposition of imperfectly digested food leads to dilatation of the stomach, and this in turn to still further pathological changes. The muscular walls lose their power, atony results, and the absorptive power of the stomach is lessened.

The bowels are usually constipated, although diarrhœa is not unusual. Some cases are characterized by an alternating constipation and diarrhœa. The stools vary in color, being sometimes light, often dark green, or watery and slimy. In many of the cases exhibiting the latter condition, the mucous production is the result of the irritation arising from the retention of scybalæ in the rectum. The urine is generally diminished in quantity, and deposits urates and often oxalates in abundance.

General symptoms are by no means wanting. The patient is languid and apt to be drowsy at inopportune times. His sleep is restless and interrupted by dreams. When sleep is sound it does not seem to afford commensurate refreshment. Headache is very common, especially in the morning on rising and after meals. The usual disposition is one of irritability and depression. The patient is inclined to look upon the dark side of everything, and especially of his own condition. In extreme cases this may amount to pronounced hypochondriasis or even melancholia.

Vertigo is associated with many cases. Trousseau first directed attention to this symptom as one of the phenomena of gastric catarrh, calling it *vertigo e stomacho laeso.* These vertiginous seizures are unattended by loss of consciousness, occur some time after eating, or are occasionally relieved by the taking of food, are not influenced by rapid movements, are often followed by headache, and disappear promptly with relief of the disordered digestion.

A dry hacking cough accompanies many cases and seems to be dependent upon associated pharyngeal irritation or inflammation. It is generally spoken of as a stomach cough. Some cases of chronic gastritis are characterized by an evening rise of temperature. When cough occurs in such cases suspicion of pulmonary mischief may be aroused, which can only be dispelled by careful physical examination of the chest.

In advanced cases of chronic gastritis, in which the stage of atrophy or cirrhosis is reached, the above-described symptoms are present in marked degree, and in addition we note decided changes in general nutrition. The patient emaciates and becomes decidedly anæmic. Flint has directed attention to the frequent association of all the symptoms of pernicious anæmia with atrophy of the gastric mucous membrane. Cases of this severe character are rarely found in the young or middle-aged. It has been suggested that many of the deaths from senile inanition are the result of gastric atrophy.

In children chronic gastric catarrh is manifested by colicky pains and gastric distress, disturbed restless sleep, irritability of temper, failure of nutrition, anæmia and abdominal protrusion (gastroptosis). In the vast majority of cases the trouble arises solely from injudicious feeding.

Diagnosis.—The questions involved in the diagnosis of chronic gastric catarrh are its differentiation from cancer and ulcer of the stomach, and the determination of the stage to which the pathological changes have extended. From cancer it is differentiated by certain negative symptoms, viz., the absence of tumor, of a history of malignant growths elsewhere, and of the cancerous cachexia. Pain is present in both diseases, but is rarely of high grade in gastric catarrh. Vomiting is more persistent in cancer and the ejected matters are often mixed with blood. Cancer rarely gives a history covering more than one, or at most, two years; hæmorrhage is not profuse; chronic gastritis is of indefinite duration. Emaciation and cachexia are prominent early symptoms of cancer; it is also quite common in cancer to have a history of a sudden and complete loss of appetite. In cancer free hydrochloric acid is not usually present in the gastric contents after dilatation has taken place, and may or may not be absent in chronic catarrh.

In gastric ulcer hæmorrhage, though less frequent than in cancer, is profuse. Examination of the stomach contents shows the presence of

hydrochloric acid in normal amount, the pain is paroxysmal and aggravated mainly by the taking of food, and is relieved by vomiting.

The stages of chronic gastritis calling for clinical recognition are simple chronic gastritis, chronic mucous gastritis and atrophy of the stomach. Their differentiation depends entirely upon the examination of the stomach contents. (*a*) *Simple chronic gastritis.* The stomach while fasting contains only a small quantity of a watery mucous fluid, which on standing deposits a sediment consisting of epithelium and remnants of food. After the test breakfast the acidity is normal or diminished, the quantity of hydrochloric acid deficient; pepsin and rennet are diminished in amount, and lactic and butyric acid are present; (*b*) *Chronic mucous gastritis.* Large quantities of mucus are found in the gastric contents under all circumstances, as shown by the reaction of the gastric contents to acetic acid. Hydrochloric acid is generally absent, pepsin, rennet and peptone much diminished and propeptone abundant. Examination of the water after lavage often reveals the presence of fragments of the epithelium of the gastric mucous membrane. (*c*) *Atrophy.* The stomach is empty during fasting. The stomach contents, after the test breakfast, are free from hydrochloric acid, pepsin, rennet and mucus.

Prognosis.—The curability of chronic gastritis depends very largely upon the extent of the changes present when the case comes under treatment. With a persistence of the causes which have brought on the disease, its natural course is to persist for months and years. Cases which have advanced to destruction of the secreting structure of the stomach are to that extent irremediable. Cases which have been cured are liable to relapse under slight dietetic indiscretion. The general failure of nutrition and constitutional depreciation, so frequently associated with chronic gastric catarrh, ofttimes develops a predisposition to secondary infections, *e. g.*, tuberculosis.

Treatment.—The successful conduct of a case of chronic gastric catarrh involves most careful attention to the minutest details of general hygiene and diet as well as to the administration of properly indicated medicines. Without the removal of *all* bad habits and the nourishment of the patient with proper food, treatment will be unavailing. If the patient is in the habit of indulging in alcohol or tobacco, it will be the best course to stop both habits *in toto*, no matter how mildly the indulgence may have been. It is exceedingly doubtful if liquors in any form are ever of use in chronic gastric catarrh, and it is certain that they are often positively harmful. Good habits in eating must be inculcated. The meals should be taken with the utmost regularity, and so arranged as to give the patient an abundance of time for eating. This allows a proper amount of time not only for thorough mastication of food, but also relieves the patient of any thought of hurrying to get through in time to attend to certain duties. Mental influences are influential factors

in gastric disorders. For this reason meals should be taken in the midst of congenial surroundings, for thus only will the mind be drawn from the cares and worries of business life. Thorough mastication of the food is always necessary. The introduction of large pieces of food into the stomach is a source of local irritation. Such ingesta, moreover, do not come into as intimate contact with the gastric juice as do small particles, and hence are retained in the stomach longer than normal and undergo putrefactive changes. Rapid eating develops another evil, viz., imperfect admixture of saliva with the food. The importance of this fluid as a digestive agent must be borne in mind.

In very many cases rest after meals is of the highest importance. Ofttimes it is necessary to order the patient to bed for a fixed period after eating. In other cases all the good effects of rest may be obtained by a restful chat with congenial friends, after meals, before resuming the occupations of the day. The more arduous the patient's labors, and that, too, whether they are mental or physical, the greater is the importance of rest.

In mild cases it is only necessary to regulate the diet in such a way as to prohibit certain well-known injurious articles, such as pastry, highly seasoned food, sweets, fatty and fried food, pork, veal, cabbage, hard-boiled eggs, etc. In aggravated cases it is often necessary to put the patient on an exclusive milk diet. Even this may disagree, in which case it is necessary to give peptonized milk or koumiss. When an exclusive milk diet is required, the patient should take from three to six pints of milk daily. Under such a restricted regimen, it will, as a rule, be found that the patient cannot go about his usual labors, but is obliged to take more rest, and this of itself is a good thing. In very aggravated cases, in which it is necessary to supplement a milk diet with other food, predigested meat preparations may be administered. In all cases it is important to stduy the influence exerted by the prescribed diet. Patients' idiosyncrasies must be respected.

Starchy foods disagree with some dyspeptics, because they undergo fermentation in the stomach. They should, therefore, be avoided in all cases characterized by flatulence. Most fruits are of value within reasonable bounds. There is one common practice in the use of fruits by dyspeptics that should be condemned, and that is, their use before breakfast, especially oranges. It is a well-known fact that acid substances taken fasting lessen the secretion of the gastric juice, and oranges are no exception to this rule. To indulge, then, in a practice which diminishes the secretion of an important physiological fluid already impaired, is to be condemned.

All measures which tend to enhance the general health are necessary. Thus the patient should get a certain amount of out-door exercise each day. The activity and duration of this exercise must be graduated

most carefully for the patient in hand. If he be one in whom the nutritive disturbances of gastric atrophy have not yet asserted themselves, and if physical strength is good, especially if the patient has been what is generally known as a " high liver," the exercise should be active. If emaciation and debility on slight exertion are increasing, the more passive the exercise the better will be the results. Patients who are too weak to take any exercise, however light, will derive great advantage from daily systematic massage. A morning cold douche or cold sponge bath, followed by brisk friction of the body, adds greatly to the general tone. The influence of hydrotherapy and mild exercise may be often obtained by surf bathing.

The clothing of the patient must not be ignored, for it is always advisable to protect from draught and damp.

Water is an important remedy in chronic gastric catarrh. In not very obstinate cases it may be drunk at stated intervals. The most efficient means of administration is the taking of a tumblerful of hot water about half an hour before each meal. This serves to rid the interior of the stomach of its coating of mucus, stimulates the muscular coat, and prepares the organ for the reception of the oncoming meal. In very severe cases it is necessary to make a more heroic use of water by washing out the stomach. The manner of introduction of the stomach tube has already been described. The operation should be performed at an hour when the stomach should, under normal conditions, be empty, and the siphonage should be repeated until the water returns clear. The frequency with which it should be repeated must be governed by circumstances. Ordinarily, lavage on alternate days will suffice. Severe cases call for daily sittings. When the washings show the presence of gastric mucus in large quantities, some advantage will be derived from the addition of a small quantity of bicarbonate of soda (sufficient to make a three-per-cent. solution), or of granular effervescent Vichy salts, to the water employed. In every case the lavage should be followed by the administration of a pint of peptonized milk or some other liquid nourishment through the stomach tube.

Electricity will help some cases; but it must be regarded as a remedy possessing a limited value. It is indicated especially in cases characterized by lessened secretory and motor powers. It is most efficient prescribed in the form of faradism, one electrode (Einhorn's stomach electrode) being introduced into the stomach and the other (a large flat electrode) applied over the epigastrium and along the spine. The current employed must be a mild one. This method of application is decidedly disagreeable, and must necessarily be reserved for severe or obstinate cases.

The administration of agents designed to aid digestion is valuable in many cases. Of these dilute hydrochloric acid heads the list. This

should be given in doses of from six to fifteen minims, well diluted, about half an hour after each meal. It aids digestion by its action as one of the constituents of the gastric juice, and converts pepsinogen into pepsin. It also exerts an antifermentative action.

Pepsin, which has been so generally prescribed for many years, is of doubtful value. Its administration should be reserved for cases which have progressed to the stage of atrophy. It should be given in combination with dilute hydrochloric acid.

Papoid ("vegetable pepsin") is much more effective in doses of one to three grains after meals.

Pancreatin is to be given in atrophic cases, but should be administered in combination with an alkali—five grains of bicarbonate of soda.

To secure the proper conversion of starchy foods into glucose, the syrupy malt extract—Trommer's or maltine—may be given. Bread may be spread with the malt, or it may be added to oat meal or other farinaceous articles of food.

MEDICINES. *Nux vomica* is the most frequently useful remedy in the treatment of chronic gastric catarrh. It is adapted to all stages of the disease. In that of atrophy, with diminished motor power, it may be given in the form of *strychnia* 2x, a one-grain tablet four times daily. Nux is especially useful in cases attended by constipation, and in whom purgative and laxative drugs have been abused. The symptoms are characteristically worse in the morning; the tongue is heavily coated; the breath is foul. There is often morning vomiting or retching, the ejected matters consisting largely of mucus. (In cases in which the symptoms are mainly those of slow digestion, Jousset recommends the alternation of *graphites* with nux vomica, giving one before, the other after meals.) *Hydrastis* is likewise important in cases characterized by excessive production of mucus. The catarrhal condition in the bowels is evidenced by the mucus-coated stools. The patient is much annoyed by a sinking sensation in the epigastrium. In many cases calling for this remedy, there are vomiting, loss of appetite, constipation and great soreness and burning over the region of the stomach. It is useful in some cases of atonic dyspepsia, especially in old people. *Pulsatilla* is another catarrhal remedy. The vomited matters contain mucus; digestion is slow, food ferments, consequently eructations and flatulence are common. It is the especial remedy for cases arising from indulgence in rich food.

Bimuth subgallate will be found invaluable in cases attended by unusual fermentation of decomposing food. It should be given in doses of from five to ten grains before meals. *Lycopodium* is also useful in flatulent cases, especially in those occurring in patients of the uric acid diathesis, with the ordinary lycopodium symptoms. *Carbo veg.* is suited to flatulent cases in which the eructations have a foul odor and taste; the tongue is thickly coated.

Bryonia is to be administered in cases in which dryness of the mucous membrane of the digestive tract is an important feature. The bowels are constipated. Food lies in the stomach undigested and causes an uncomfortable sensation, as if a stone were in the epigastrium, which is greatly aggravated by any exertion or motion. Liver disturbance is usually associated with that of the stomach.

In obstinate cases attended by distress and tenderness at the epigastrium, much flatulency, and vomiting of quantities of ropy mucus especially in the morning, *argentum nitricum* should be administered. It is best to repeat it before meals, preceded, about fifteen minutes, by a cup of hot water Of the second decimal dilution freshly prepared in distilled water, give twenty drops in one ounce of distilled water. No remedy is as generally useful. After thorough washing of the stomach the same dose may be introduced through the tube. *Arsenic* and its preparations are invaluable in many cases. It is indicated when the symptomatic group is that characteristic of gastric iritability. There are burning pains in the epigastrium, great thirst, restlessness and anxiety. These symptoms are noted with especial frequency in cases arising from alcoholic excesses and indulgence in ice-cold food and drinks. Ringer has strongly recommended the use of Fowler's solution in doses of one drop before eating as a remedy for the cure of the vomiting and gastric irritability attending the gastritis of drunkards. *Bismuth subnitrate* is also indicated in cases of gastric irritability. There are burning, griping, lacinating pains, associated with frequent vomiting. It may be given either in low trituration or in the crude drug one-half to one hour before meals. *Creasote* is useful when the gastric irritability is associated with almost complete cessation of digestion. Food is retained unaltered in the stomach for hours, and then is vomited. This remedy may be given either in potency or crude form. It is highly recommended in the gastric catarrh attendant upon tuberculosis. It very often checks pain after eating. *Sepia* very frequently gives most excellent results in the treatment of the gastric catarrh of neurotic women. It is indeed a question if the gastric difficulty in the sepia case does not possess a predominance of the neurotic element. Uterine troubles are present, and the patient is of the characteristic sepia character. Acid eructations, fickle appetite, desire for stimulating food, burning in the epigastrium after eating, heavy uratic deposits in the urine, burning aching in the back and gastralgic pains, are the main symptomatic indications for sepia. The sepia case may, indeed, be summed up as a combination of the catarrhal, the neurotic, and the lithæmic. *Cinchona* may be prescribed for advanced cases with marked debility, and is useful for gastric catarrhs secondary to exhausting acute diseases. Pain is not a prominent symptom at any time. Fermentation is active, consequently there are great epigastric fulness and frequent eructations. The appetite is completely in abeyance.

Sulphur is indicated in old cases not yielding to ordinary remedies especially when complicated with hepatic disease and hæmorrhoids. The usual sulphur symptoms aid in the selection.

GASTRIC ULCERATION.

Dr. Brinton states that ulceration of the stomach is found in 5 per cent. of deaths from all causes. It occurs in a variety of forms, especially as an attendant upon malignant disease and some of the acute infectious diseases.

In conditions involving the liver, heart, and lungs, resulting in congestion of the vessels of the stomach, hæmorrhage may take place into its coats with digestion of the overlying mucous membrane. This form of ulceration is superficial and designated " hæmorrhagic erosion."

When the term " gastric ulcer " is used without qualification, reference is made to the " peptic," " simple," " round " or " perforating " ulcer, which was first accurately described by Cruveilhier (1830).

SIMPLE ULCER OF THE STOMACH.

Definition.—A form of ulceration of the stomach, usually oval or round in shape, involving first the mucous membrane, gradually attacking the deeper layers, and now believed to be dependent upon the action of the gastric juice upon a portion of the gastric tissues, the nutrition of which has been impaired.

History.—This lesion as now observed did not attract the attention of pathologists until 1793, in which year it was very ably described by Baillie. In 1824 Abercrombie gave an account of the lesion, detailing nearly all the phenomena as we see them in the present day. In 1830 Cruveilhier, and in 1839 Rokitansky, published descriptions of gastric ulcer of such accuracy that they have remained authoritative to the present day.

Etiology.—It has been attempted to determine the frequency with which gastric ulcer occurs by an investigation as to the number of cases in which cicatrices are found in the stomach in a large series of autopsies. Observations thus collated seem to show the existence of present or healed ulceration in about 5 per cent. of all the autopsies. Females are more frequently affected, in the proportion of three to two. The majority of cases (75 per cent.) occur between the ages of twenty and sixty, the relative frequency throughout each of these decades being about the same. Lebert's experience, based on observation of cases seen during life, shows 70 per cent. of his cases to have occurred between the twentieth and the fortieth years. Gastric ulcer is rarely observed in childhood, but Colgan reported a case in a child aged two and a-half years, and Hogan one in a child of five, caused by the kick of a horse.

Males seem to be attacked at a somewhat greater age than are females. There is good reason for believing that gastric ulcer occurs with especial frequency among the poorly nourished and the overworked. Traumatism has been assigned as the cause in some instances, but, as a rule, when injury or pressure has produced a solution of continuity of the gastric mucous membrane, the lesion heals very promptly. The same result follows destruction of the mucous membrane by corrosive poisons. Chlorosis and anæmia favor the evolution of some cases; oftener, however, the ulcer itself is responsible for the hæmic changes. Circulatory disturbances in the stomach arising from heart disease, cirrhosis of the liver, vomiting of pregnancy, and vascular disease, are exceptional causes. Cooks, shoemakers, tailors and weavers seem to be predisposed to the disease by reason of their occupations.

Pathology and Morbid Anatomy.—The pathology of ulcer of the stomach has been the subject of quite diversified views. Inasmuch as ulcerations presenting the characteristics of gastric ulcer occur in no other organ than the stomach, it is generally conceded that the gastric juice plays an important part in the production of the lesion. Mathieu adopts the theory first promulgated by Cruveilhier to the effect that there occurs primarily a gastric catarrh, the action of the gastric juice upon the altered tissues producing the ulceration. Virchow taught that the primary lesion consisted of a derangement of the gastric circulation, —embolism or thrombosis—the action of the gastric juice on the anæmic area completing the pathological process. Klebs claims that the malnutrition of the gastric mucous membrane sometimes arises from a spastic condition of the gastric arteries. Rindfleisch believes the trouble to arise primarily from hæmorrhagic infarctions. Other pathologists have pleaded for an interference with the nutrition of a small portion of the gastric mucous membrane in association with increased acidity of the gastric juice, or alterations in the composition of the blood, leading to diminished alkalinity of that fluid. Pavy, for example, believed that diminished alkalinity of the blood was an important etiological prerequisite. Ewald holds to the view that we do not have to deal so much with diminished alkalinity of the blood as with alterations in its composition by reason of which insufficient cell nourishment ensues. The evidence in favor of a primary alteration in the blood is strong, for anæmia, chlorosis and amenorrhœa are often seen in conjunction with gastric ulcer. It must be remembered, however, that the blood changes may be secondary to the ulcer in many instances. Riegel advocated the view that a hyperacidity of the gastric juice is the important cause of simple gastric ulcer. Examinations by other clinicians demonstrate that while hyperacidity is often present, it may be absent. Chemical examination shows that hydrochloric acid always exists in the stomach contents. Rosanna observed one case of gastric ulcer due to syphilis

A tubercular origin undoubtedly exists in some few cases. Böttcher discovered colonies of micrococci in the ulcerating tissue and thought them the primary cause.

Ulceration of the stomach is nearly always confined to a single limited area; exceptionally, the ulcers are multiple. The ordinary size of the lesions ranges from that of a ten-cent piece to that of a quarter-dollar. Larger ulcerations have been observed, even to the size of the one reported by Habershon, which extended nearly from pylorus to cardia. Welch's studies show that the most frequent site of ulceration is the posterior wall of the pyloric portion of the stomach near the lesser curvature. Ewald and Nolte claim that the point of greatest frequency is the greater curvature near the pylorus, *i. e.*, at the point at which the gastric juice collects in greatest quantity. The ulcer is usually round or oval in shape; exceptionally it may present an irregular outline. Its edges are sharply cut and its interior funnel-form. The character of the floor of the ulcer depends entirely upon the depth to which the destructive process has extended. Recent ulcers exhibit no inflammatory changes whatever in the surrounding mucous membrane; in old cases the edges are hard and thickened.

In many cases the tendency of the ulceration is to extend in depth, ending in perforation. The contents of the stomach then escape into the peritoneal cavity with disastrous results. Fortunately in about 40 per cent. of these cases, according to Leube, such a misfortune is obviated by adhesions forming between the stomach and surrounding structures. Sometimes the inflammation and ulceration extend into the parts attacked, and thus are occasioned abscesses of the spleen, liver, pancreas, etc. The normal movements of the stomach interfere in some degree with the formation of adhesions, especially is this the case with adhesions between the stomach and the anterior wall of the abdomen. This fact suggests the greater seriousness of ulcers involving the anterior gastric wall.

Ord has observed the frequent association of ulcer and heart disease. But he is inclined to regard both troubles as arising from a common cause, as he thinks the ulcer stimulates necrotic rather than inflammatory or thrombotic lesions.

Sometimes the necrotic process involves the walls of one of the important bloodvessels, *e. g.*, the splenic artery, when profuse and even fatal hæmorrhage results.

Symptomatology.—The symptomatic range in gastric ulcer is a wide one. Cases are known to occur in which not the slightest clinical evidence of ulceration exists, the ulcer being discovered after death from some other disease; still other cases make themselves known for the first time by hæmatemesis; still others present only the phenomena of an ordinary dyspepsia; and of the remainder, the majority present all the clinical phenomena generally considered characteristic of this disease.

The important symptoms of ulcer are pain, vomiting and hæmorrhage. Of these pain is regarded as the most constant. It is generally severe, occurring paroxysmally, and is circumscribed; it is aggravated after eating and is relieved when the stomach is empty. Sometimes it is diffused over the epigastrium. Between the paroxysms there is, as a rule, a dull soreness in the epigastrium. The characteristic pain of gastric ulcer is in the epigastrium beneath the ensiform cartilage. Cruveilhier has described as of frequent occurrence a pain in the back, which may be interscapular or dorso-lumbar. Pressure in almost every instance greatly aggravates the pain; cases in which the converse obtains are very exceptional. Rest affords great relief. It has been claimed that the posture in which relief of pain is the greatest affords a reliable guide as to the location of the ulcer. But this statement lacks the confirmation of extensive experience. Reflex pains sometimes occur, and include intercostal neuralgia, pain in one or the other shoulder and pain in the loins. During the course of cicatrization the pain is usually intermittent. Exceptionally, it has continued long after the completion of cicatrization, probably because some terminal nerve filaments have become entangled in the cicatrix.

The vomiting of gastric ulcer presents no characteristic features. It takes place shortly after eating. It is so frequently present as to form a pretty constant symptom. In those cases in which it is absent the ulcer generally occupies an unusual situation, *e. g.*, the lesser curvature or anterior wall of the stomach. Usually the vomiting is preceded and accompanied by pain. Examination of the vomited matter always reveals the presence of hydrochloric acid, often in excessive quantity.

While not the most frequently present, hæmorrhage is the most important symptom from a diagnostic standpoint. Hæmorrhage sometimes occurs, but owing to the small quantity of blood effused, the blood escapes by way of the bowels and so does not attract attention. The quantity of blood lost will vary greatly in different cases. It is not infrequently so great as to lead to a fatal issue. The greater the hæmorrhage the more likely it is to be due to ulcer. When the effused blood is large in quantity and is discharged entirely by the bowels, the fæces acquire a tarry consistence and are black or dark brown in color. When the blood is vomited, it is coagulated from the action of the gastric juice, and is often of a dark brown color. Hæmatemesis often occurs without the slightest premonition and is apt to be associated with a sensation of warmth in the epigastrium. It is very rarely indeed that the first hæmorrhage is sufficiently severe to cause death; this result usually following upon several attacks of bleeding.

Peter observed an increased epigastric surface temperature of 3.6° F., in one case of gastric ulcer, especially during the paroxysms of pain. He therefore argued for an inflammatory origin of the trouble.

Aside from the pain, vomiting and hæmorrhage, the gastric symptoms of ulcer present no special points of interest. They may be summed up as those occurring in any disorder of digestion. The bowels are generally constipated, probably because of the small quantity of food taken.

Amenorrhœa is a very common symptom, but it must be regarded as a conservative one, just as it is in other exhausting and debilitating diseases.

The general health of the patient may or may not be disturbed. When pain is slight and food is retained, the general condition of the patient is most excellent. When, however, suffering is great and vomiting and hæmorrhages frequent, general nutrition necessarily becomes impaired. A most profound anæmia may thus develop, the patient even becoming dropsical.

Perforation of the ulcer sometimes takes place, and is an almost inevitably fatal accident. It is believed to occur in about 6 per cent. of all cases. It usually follows immediately after some strain is brought to bear on the walls of the stomach, as excessive vomiting, coughing, sneezing, violent exertion, or distention of the organ with food. A physical sign of perforation is found in loss of liver dulness, owing to the escape of gas into the peritoneal cavity.

When the stomach contents escape into the general peritoneal cavity severe pain is experienced in the epigastrium and spreads rapidly over the entire abdomen. Symptoms of collapse follow shortly.

The urine is diminished in quantity and its specific gravity increased. An alkaline reaction in association with diminished or absent chlorides is regarded as of bad omen.

Diagnosis.—Gastric ulcer must be differentiated from gastralgia, catarrhal gastritis, cancer, and neurotic vomiting. The diagnostic symptoms as already suggested are, pain, vomiting, hæmorrhage, and the presence of hydrochloric acid in the ejecta. Unfortunately, however, no one symptom or sign is surely indicative of ulcer. From gastralgia, ulcer is differentiated by the character of the pain, which bears no definite relation to the taking of food in the former, while in the latter the pain is almost always aggravated after eating. In gastralgia, firm pressure relieves; in ulcer it aggravates. In gastralgia the tender point varies from time to time, in ulcer it is apt to be fixed. In ulcer, pain of a dull character continues between the paroxysms; in gastralgia, the interparoxysmal periods are usually free from pain. In gastralgia, general nutrition is, as a rule, good; in ulcer it is nearly always impaired. Neurotic symptoms are nearly always present in gastralgia and absent in ulcer.

The differentiation of ulcer and gastric catarrh is rendered difficult because the majority of cases of the former are associated with more or

less gastritis; hence, symptoms of the latter are frequently present. The diagnosis is to be based on the absence of symptoms suggestive of ulcer, and the examination of the vomited matters, which in ulcer nearly always contain hydrochloric acid in excess; in gastric catarrh the free hydrochloric acid in the gastric juice is diminished, in severe cases greatly so.

Cancer is attended by evidence of a tumor, occurs generally in patients at or beyond middle life, runs a course of at the most two years, hæmorrhage, though frequent, is rarely profuse, hydrochloric acid is absent, a history of malignant growths in other portions of the body is often obtainable, cachexia is marked, epigastric pain is more continuous than in ulcer, and the course of the disease is not characterized by any marked remission of symptoms.

In neurotic vomiting other hysterical manifestations are usually present. The general nutrition is not disturbed to the extent one would expect from the severity of this symptom. The vomiting, moreover, occurs independently of the time of taking food.

Prognosis.—The prognosis of ulcer of the stomach depends very largely upon the period in its course during which it comes under treatment. When symptoms are unobtrusive, and the first indication of serious mischief is found in a profuse hæmatemesis, the ulceration may have advanced to an incurable condition. Some cases progress so insidiously that perforation affords the first evidence of danger. The majority of cases make good recoveries under suitable dietetic and hygienic measures. Subsequent to the healing of the ulcer, complications may occur. These consist of cicatricial narrowing of portions of the organ leading to obstruction, and later, to dilatation, also entanglement of nerve filaments in the cicatrix with resulting gastralgia.

Treatment.—The essential element in the treatment of gastric ulcer is complete general and local rest. The patient should be put to bed as soon as the diagnosis of ulcer is made. Local rest is to be secured by rectal alimentation. This course aids also by reducing the hydrochloric acid production to a minimum. Mathieu advocates in addition to this the free internal use of alkalies, believing that the ulcer is the result of the excessive production of hydrochloric acid. If pain is very great, it may be relieved by the application of moist heat to the epigastrium. In the course of three or four days, nourishment *via* the stomach may be permitted. Foods the basis of which is milk are the best. If milk is decided upon, it is better given cooked with a little flour, as this combination does not form so firm a coagulum in the stomach as does raw milk. Other foods allowable are broths, defibrinated blood, egg albumen, buttermilk, and still later, white meat of poultry, sweet-breads, and starchy foods. In all cases the return to solid foods must be made with the greatest circumspection, for sometimes a remarkable tendency to relapse is noticeable.

In the case of severe hæmorrhage the patient should swallow small pellets of ice. For nourishment, nutrient enemata must be relied upon. Iced tea and iced peptones may be given by the mouth. If collapse is imminent, hypodermics of ether and camphor (1 to 6) should be given. In some cases transfusion of salt solution may be necessary, and prove sufficient to save life.

For obstinate vomiting ice should be given internally. Champagne, morphia or chloroform may prove efficient. In obstinate cases the actual cautery should be applied to the epigastrium.

The remedies which will give the best results are *nitrate of silver*, *arsenicum*, *uranium nitrate*, *kali bichromicum*, *mercury*, *bismuth* and *hydrastis*. *Arsenic* is highly praised by Pope, Hughes and Hale, the first of whom rocommends it especially when the ulcer invades the pyloric portion. The symptoms often call for it, and I have witnessed good results from its use. *Nitrate of silver* is used by both schools. Among many of the old school its beneficial effects are believed to be due to local action. Owing to the smallness of the dose prescribed (one-fourth of a grain in pill form) it is hardly likely that it can exert much of a local chemical effect. The association of chlorosis and pain in the epigastrium below the ensiform cartilage, extending through to the spine, are important indications. *Mercurius corrosivus*, where the epigastrium is distended and sore, not permitting light pressure, even of clothing. Burning, gnawing and darting pains. Third to the sixth decimal dilution. *Uranium nitrate* was recommended by Dr. Blake because of the power of the drug to produce ulceration at the pylorus in the lower animals. Drysdale has applied it in practice with good effects, and the observation has been corroborated by others. *Hydrastis* and its preparations owe their efficacy to the beneficial action of this medicine on the mucous membrane. *Kali bichromicum* is prescribed more frequently upon the character of the vomiting, which is exceedingly ropy, although investigation will reveal many symptoms suggesting its use. *Phosphorus* suits cases associated with obstinate vomiting. I have had several admirable results from the use of this medicine, prescribing it upon the well-known character of the vomiting, *i. e.*, as soon as fluids become warm in the stomach. Evidence of fatty degeneration in any of the organs favors its selection.

For the hæmatemesis, *ipecacuanha* and *hamamelis* are frequently given. *Hydrastinine hydrochlorate* should be tried in the second decimal dilution. If obstinate, ice to the epigastrium and morphia subcutaneously are the most successful measures.

CANCER OF THE STOMACH.

Varieties.—The term cancer of the stomach is a generic one, including quite a variety of malignant tumors appearing in this situation. They are: Scirrhus, encephaloid, colloid, polypoid and telangiectatic cancer.

History.—While digestive disorders resulting from cancer of the stomach must have existed for ages, the actual recognition of malignant disease in this organ was not recorded in medical literature until the eighteenth century, at which time Morgagni reported a series of cases That pathologist adopted scirrhus as the type of all malignant growths of this organ. Encephaloid was next described by Laennec in 1812, and colloid cancer by Otto in 1816. The microscopic appearances of the different varieties were subsequently described by Cruveilhier in terms that have never been improved upon.

Etiology.—The causes of cancer of the stomach are no better understood than are those of malignant tumors in other situations. Certain factors undoubtedly exert a predisposing influence upon the appearance of the affection, and of these age is unquestionably one of the most important. Three-fourths of all cases have been observed to occur in subjects between the ages of forty and seventy years. Still the disease is observed with sufficient frequency in young adults, *i. e.*, those between the ages of twenty and thirty, to put the physician on the lookout for it in cases of persistent gastric disorder at that time of life. Most of the standard authorities contend that it may even attack children, though admitting that in them it is one of the rarest of diseases. Dujardin-Beaumetz holds, however, that all such cases are but examples of mistaken diagnosis.

Although the influence of heredity in the etiology of cancer seems to be generally admitted, most authorities affirm that such a relation can be proven in but a limited number of instances. Statistics bearing on this point, prepared by different observers, present great variations, the extremes being from 7 (Lebert) to 14 per cent. (Welch). Both of these figures must exceed the actual truth, for some of the so-called hereditary cases must occur as mere coincidences rather than from any hereditary predisposition.

Physicians who have spent much labor in the investigation of cancer, have pleaded for a local origin of many malignant growths. So in cases of cancer of the stomach, local disease and injury of this organ have been alleged to predispose to cancer in this situation. Thus it has been claimed that the tumor develops in old cicatrices of healed gastric ulcers. Cases so arising have most undoubtedly been observed, but they must be infrequent; for gastric ulcer occurs with greater frequency in the female sex, cancer in the male. Were cancer a common sequence of ulcer, it is hardly likely that such a sexual predisposition could exist. It has also been said that those who have disregarded all dietetic rules and have persistently abused their stomachs are often the victims of the disease, a statement that is met by the observation that cancerous patients nearly always give a history of preceding good health. Alberts, Andral, and Dittrich have reported cases that apparently have arisen from traumat-

ism; but such cases are, after all, exceptional. While, therefore, chronic disease may be an etiological factor by reason of the production of local irritation, the importance of such causes must not be overestimated.

Pathology and Morbid Anatomy.—Cancer of the stomach is a disease of quite frequent occurrence, it being generally admitted that about one per cent. of all deaths in subjects past twenty years of age arise from it. Regarding the frequency of malignant disease of the stomach as compared with the same conditions involving other portions of the body, observations show that the uterus and the stomach are the sites of over one-half of the cases reported in literature. The portion of the stomach involved is, in more than one-half of the cases, the pylorus and the adjacent area. The lesser curvature is the part attacked with next greatest frequency, while the cardia is involved in only about one case in twelve. In some few instances the morbid growth involves the entire organ. Cancerous infiltration of the pylorus results, as a rule, in obstruction of this gateway from the stomach, either by the encroachment of the tumor on the lumen or by thickening of the muscular layer which guards it. The natural sequence of the stenosis thus caused is dilatation of the organ. Still, the reverse condition, contraction of the stomach, sometimes ensues, though usually in conjunction with cancerous infiltration of the entire organ or cancer of the cardia. The size to which the stomach may be reduced is occasionally remarkable; thus Welch has referred to the possibility of the stomach being sufficiently large to accommodate a body no larger than an ordinary hen's egg.

Cancer of the stomach may occur either as a primary or as a secondary lesion, the former being the case, however, in the vast majority of instances. Secondary cancerous deposits are very liable to occur in these and are noted with especial frequency in the lymphatic glands, the liver, the peritoneum, the pancreas, and the lungs. Occasionally cancer occurs simultaneously in the stomach and some other portion of the body, *e. g.*, the uterus. When cancer of the stomach appears secondarily to malignant disease in other localities, it follows most frequently similar tumors of the mammæ and the œsophagus.

Macroscopic Appearance of the Lesions. Cancer of the stomach may show itself as a well-defined tumor projecting into the organ, as a diffuse infiltration of its walls, or as an annular growth constricting some one of its parts.

The starting point of the pathological changes is now acknowledged to be the mucous membrane. Thence they extend to the submucous tissue, which being loose and yielding in structure, affords the growth a very favorable opportunity for spreading. Still later the muscular layer is implicated, although this structure offers considerable resistance to invasion. Finally it involves the subserous and serous coats; these are favorable structures for the spread of the growth the evidences of

which in this situation are manifested by nodules of various sizes projecting from the peritoneal surface. Sometimes adhesions form between the stomach and adjacent organs and thus provide an easy means for spread of the growth by continuity of structure.

Ulceration sooner or later takes place in the majority of cases of all varieties of gastric cancer. This is the result of the natural degenerative changes incident to cancer in general, and to the action of the gastric juice on the depraved tissue in the cases of cancer of the stomach in particular. The rapidity and extent of the ulceration is influenced to a great degree by the variety of the tumor, for it has been observed to be the most severe in tumors of rapid growth.

Considering *seriatim* the principal varieties of malignant disease of the stomach, *medullary* cancer as being of most frequent occurrence in this locality deserves first mention. It is of rapid growth and its substance of soft consistence. Upon section it presents a whitish or reddish-gray color and the cut surface often exudes a milky juice. It tends to deep ulceration, and hence is more frequently associated with hæmorrhage than are other varieties of cancer.

Scirrhus may appear either as a circumscribed hard tumor or as a diffuse thickening and induration of the walls of the stomach. It is especially apt to involve the pylorus and adjacent areas.

Cylindrical-celled epithelioma presents about the same general characteristics as medullary cancer. Its consistence, however, is firm like that of scirrhus.

Colloid cancer usually occurs as a diffuse thickening involving the entire extent of all the coats of the stomach, extending even to the peritoneum. Exceptionally it appears as a definite circumscribed growth. It extends by metastasis to other parts.

Symptomatology.—As in the case of many other chronic diseases of the stomach, the symptomatic range of cancer of the stomach is a wide one. The characteristic case begins with a history of dyspeptic symptoms, presenting no special features significant of the serious nature of the oncoming malady. Next, the general health is gradually undermined the patient emaciating and losing strength. Epigastric pain appears and increases very rapidly in severity. Vomiting now sets in and is very little influenced by treatment, emaciation increases, and anæmia and cachexia are superadded. Physical examination now discloses the presence of an epigastric tumor. All cases do not follow the typical course thus outlined, for it is a common experience to meet with marked departures from the characteristic type. In some of these the disease runs a nearly latent course, symptoms being either absent or of slight intensity almost up to the time of the fatal issue. The emaciation, the prostration and the anæmia may all be present and indicate only too certainly the presence of some serious malady, but subjective and object-

ive local symptoms suggestive of the nature and location of the pathological changes are noteworthy only because of their absence. Sometimes cancer runs a latent course up to a certain period, when, under the influence of some exciting cause, active symptoms appear and the subsequent progress is rapid. The clinical history of such cases is often puzzling, and unless unusual care is paid to the physical signs, diagnostic errors are easily committed.

The symptoms of cancer of the stomach calling for especial attention are: Loss of appetite, pain, dyspepsia, vomiting, hæmorrhage, a palpable tumor, the absence of hydrochloric acid from the gastric juice, anæmia and adenopathy.

Loss of appetite is one of the earliest symptoms in cases of gastric cancer, being associated, as a rule, with a feeling of pressure and fulness in the epigastrum. The loss of appetite is often so sudden as to impress the patient definitely. It varies in degree in different cases, in some consisting of a repugnance to all food, while in others there is a disgust for certain articles, as meat. The dislike for meat finds a rational explanation in the absence of hydrochloric acid from the gastric juice so commonly observed in cases of cancer of the stomach. Anomalies of taste are occasionally manifested; sweet articles may taste bitter or sour. Sometimes the appetite is capricious, at one time being good, and at another bad. The tongue is nearly always heavily coated, here affording a point of distinction from the condition observed in gastric ulcer.

Of all the symptoms of cancer of the stomach *pain* is the most constant, being present, according to Ewald, in 92 per cent. of all cases. It likewise appears very early in the course of the disease, coming on gradually and increasing in intensity with the onward march of the malady. The exceptional cases in which it is noteworthy by its absence are found for the most part in the aged. It is most frequently referred to the epigastrium, but it may also be most marked in the hypochondrium, the interscapular region, the shoulders or the loins. An attempt has been made to show some definite relation between the site of the cancer and the situation of the pain; thus Brinton claimed that pain between the scapulæ indicated cancer of the lesser curvature. Extended experience has proven the fallacy of this idea, as in gastric ulcer the pain is aggravated by the ingestion of food, but the suffering does not reach its maximum until long after eating, when the process of digestion should be well advanced. It is often quite severe when the stomach is empty, and is usually described as of a burning, lancinating, clawing character. Still it may present any character. Very often there is epigastric tenderness especially marked over the tumor.

Gastric symptoms other than pain arise by reason of the dilatation of the stomach, and the gastric catarrh which is so frequently associated with cancer of the stomach. These differ in nowise from the same

symptoms when occurring as independent disorders. They are discomfort after eating, epigastric fulness and distention, nausea, acid eructations, hiccough, etc.

Vomiting is nearly as constant a symptom as pain. As a rule it does not appear until other manifestations of indigestion have existed for some time. It may, on the contrary, be one of the earliest symptoms; indeed it is perfectly possible for it to be the first symptom, and again in these very cases to be so violent and uncontrollable as to lead to death by exhaustion within a short period after its inception. Vomiting is especially apt to be present when the cancer involves the pylorus, in which case it occurs generally about an hour or so after eating. When the growth involves the cardia, the vomiting occurs almost immediately after partaking of food. Exceptions to these statements may be observed, so that one should not always judge of the location of the tumor by the length of time intervening between the taking and rejection of food. When the disease is of long standing and dilatation of the stomach has taken place the vomiting partakes of the characteristics of that condition; it does not occur so frequently, and the vomited matters are excessive in quantity. After continuing for a time the vomiting may disappear spontaneously, usually, it has been said, because the cancer breaks down and the pyloric obstruction is relieved. In some cases food is rejected as soon as it enters the stomach, because of general gastric irritability.

Hæmorrhage from the stomach, though a symptom of cancer, is not as characteristic of this condition as it is of ulcer of the stomach. The quantity of blood vomited is not usually large. When profuse some blood escapes by way of the bowels and shows itself in the stools, which assume a dark tarry appearance. Slight hæmatemesis is very common, the blood vomited being so changed as to merit its usual description of "like coffee-grounds." Profuse hæmorrhage is observed almost exclusively in the late stages of cancer; it is especially apt to occur with the soft varieties of malignant growths.

The really important symptom and the one without which a diagnosis of cancer cannot be considered as positive is the presence of a tumor. It is generally stated that this can be discovered in about 80 per cent. of the cases. While thus speaking of the importance of the tumor as determining the diagnosis, its presence or absence cannot be regarded as absolutely settling the question of a diagnosis of cancer of the stomach, for the growth may be so situated as to make it utterly impossible to recognize its presence, and tumors palpable in the epigastric region may spring from other viscera than the stomach. Cancer of the pylorus can generally be discovered by palpation; cancer of the anterior walls is readily discovered even when of small size; the cardia is so situated that cancer involving this part is palpable only when the

growth extends downward and involves other parts of the organ. When in the case of pyloric cancer the size of the tumor is such that it projects beyond the border of the liver, or its weight is so great that it drags down the stomach, no difficulty will be experienced in discovering it. In cases in which its presence is not thus made prominent, the palpating fingers should endeavor to examine well beneath the free border of the liver. When the pylorus is attached to the liver by adhesions, or the latter organ itself is enlarged, the discovery of the tumor is often impossible. The usual situation in which the tumor is found in pyloric cancer is the epigastrium somewhat to the right of the median line, but it may be felt to the left or in the umbilical region. Exceptionally it has been palpated as low as the iliac crest or in the hypogastrium. In consistence the tumor seems to be hard, firm and nodular. It may be either movable or immovable, in the latter case being fixed by adhesions. It is not affected by the respiratory movements of the diaphragm, except in those instances in which it is bound to the liver by adhesions. In some cases the distention of the stomach by gas may bring into discoverable position a growth whose previous existence had been searched for in vain. *Per contra,* a tumor which had been readily palpable disappears on the distention of the stomach or colon with flatus. Percussion affords but little information in comparison with palpation. The note over the tumor is usually that of tympanitic dulness. The physical signs of diffused cancer are unsatisfactory. Often there may be detected a sense of abnormal resistance in the epigastric region. Sometimes it is possible to palpate the outlines of the thickened and contracted stomach.

In cancer of the cardia the general contraction of the organ sometimes leads to marked sinking in at the epigastrium.

In cases in which all examinations are negative it may be wise to distend the stomach with gas.

The bowels are almost invariably disturbed in some way. Usually constipation prevails, because the patient partakes of but little food, and that little is vomited. Then, too, the peristaltic movements of the intestines are sluggish. In other cases, especially in the terminal stages of the disease, diarrhœa is the predominant condition. It is usually due to the irritation of undigested food.

There are no changes of diagnostic value in the urine. Very often deposits of urates are found. A slight albuminuria is by no means uncommon. The excretion of urea is diminished because of the low state of the nutritive processes of the body. Indicanuria and acetonuria are also present.

Several years ago Von der Velden called attention to the fact that the gastric juice, in cases of cancer of the stomach, did not contain free hydrochloric acid. Extended observation has shown the truth of this observation in the majority of instances; but it is also known that the same con-

dition is present in other affections. Nevertheless it affords a sign of considerable value in many doubtful cases.

Anæmia is constantly present in the advanced cases. The number of red blood-cells has been found to decrease, while that of the leucocytes increases. Lepine discovered a number of microcytes in the blood. Associated with the high grade of anæmia is a progressive emaciation. The patient assumes a cachectic appearance. The skin becomes dry and harsh and assumes a dirty yellow color. These changes must be regarded as symptomatic of the failing nutrition and not as distinctive of the cancerous diathesis.

Sometimes marked œdema of the lower extremities is observed. This is usually the result of the general anæmia. Sometimes it arises mechanically from the pressure of enlarged retroperitoneal glands on the ascending vena cava.

Swelling of the supraclavicular glands is an interesting symptom, which was heralded by Virchow, Henoch and Troisier as an important symptom. Its value is greatly lessened by the limited number of cases in which it occurs.

The temperature is generally normal in the early stages of cancer of the stomach. Later, pyrexia appears, the temperature as a rule not rising higher than 102° F.

In rare cases coma, bearing close resemblances to diabetic coma, may set in and close the scene. The usual termination of cancer of the stomach is in death by exhaustion.

Diagnosis.—The discovery of an epigastric tumor in association with a history of obstinate vomiting, epigastric pain, and progressive emaciation and anæmia is all sufficient for the diagnosis of cancer of the stomach. But all cases do not give such clearly defined symptoms, and, therefore, require most careful study of all the clinical phenomena. Great claims have been made for the value of the absence of free hydrochloric acid from the gastric juice as indicative of cancer, but it has been most conclusively shown that circumscribed cancer of the stomach, unattended by any lesion of the mucous membrane, has no effect on the secretion of hydrochloric acid. On the other hand, such cases are rarely observed. The discovery of free hydrochloric acid in the gastric contents therefore affords strong presumptive evidence that the ailment under study is not cancer.

The occasional discovery of small portions of malignant growths in the vomited matters or the stomach washings affords valuable evidence. Care must be taken, however, that the examination of these pieces is made by an expert, as incorrect conclusions may readily be deduced from imperfect microscopical observations.

Sometimes the cancerous tumor pulsates owing to its proximity to the abdominal aorta, and thus an incorrect diagnosis of aortic aneurism

may be made. Careful examination, however, shows that the tumor does not expand, but moves only in a vertical direction; in the case of aneurism it expands in all directions. An exception to this differential point is found in the very rare cases in which the tumor surrounds the aorta.

The confusion of hard fæcal masses in the colon with gastric tumor is to be obviated by thoroughly cleaning out the bowel by the use of a purgative and a full enema before the examination.

The diseases with which cancer of the stomach is most liable to be confounded are gastric ulcer and chronic gastric catarrh. The differentiation of ulcer and cancer has already been given (see page 564). In chronic gastric catarrh no tumor is discoverable, the disease may occur at any age, its duration is indefinite, hæmatemesis is very rarely observed, free hydrochloric acid is found excepting in the terminal stages, general failure of nutrition is observed only late in the course of the disease, the pain is not as severe nor so constant as in cancer, and the course of the disease is characterized by numerous remissions and exacerbations.

Cases of hysteria with obstinate vomiting and emaciation (anorexia nervosa) sometimes present a confusing resemblance to cancer, but while the hysterical patient may present in these cases a profound cachexia, careful examination will show that the skin still preserves its turgescence.

Cancerous infiltration of the stomach walls, and sclerosis with thickening of the same, can only be differentiated by microscopic examination. The outward appearances of the two conditions are often absolutely identical.

Prognosis.—The prognosis of cancer of the stomach is absolutely unfavorable, the disease running a progressively fatal course, ranging in duration from one or two months to two years after the appearance of the initial symptoms. The tendency to complications is great, Pierre, for example, finding sixty-eight out of one hundred and forty-three cases complicated by some pulmonary affection. As already stated, the usual cause of death is exhaustion, but Zuccarelli has reported a case in which it occurred from peritonitis following perforation. Treatment can do considerable in the way of relieving symptoms, as will be explained presently. Surgical operations sometimes prolong life, but so far as is known have never affected a permanent cure; indeed, the essential factor for success of extirpation of the growth, namely, its early discovery before glandular infection has occurred, is not obtainable in gastric cancer.

Treatment.—The treatment must be conducted with the view of relieving symptoms and conserving the strength of the patient. The most distressing symptom, and the one which demands prompt relief, is the pain. For this purpose we are sooner or later obliged to turn to opiates, using either *svapnia* or *morphia*, according to the results obtained. In an incurable affection like cancer, running a definite course, the fear

of producing the opium habit need not be entertained. The drug must be given in proper doses and at suitable intervals to give the sufferer a bearable existence. It must not be understood from this statement that the writer advocates the indiscriminate use of narcotics, as some cases may be treated entirely without their aid, while others require but little, and this in the late stage.

Vomiting may be allayed by swallowing pellets of ice or sipping iced champagne, and the prescription of a proper diet. These failing, washing out of the stomach should be resorted to. The influence of this operation in cancer of the stomach is sometimes wonderful, not a single paroxysm of vomiting occurring after the first séance with the stomach tube.

Hæmatemesis is to be treated according to the directions given in the article devoted to that symptom.

Constipation is to be relieved by the use of enemata.

The diet should be of the lightest possible character. The absence of hydrochloric acid from the gastric juice must be recognized, and albuminoids supplied in limited quantity. The patient will probably thrive best on a liquid diet, such as milk (peptonized) and koumiss.

In some cases rectal alimentation will be required.

Operation will benefit some cases. Should the disease be recognized early in its career removal of the growth may be attempted, but is at the best an extremely hazardous procedure, offering only temporary alleviation of symptoms. Some cases have been treated by divulsion of the pylorus with some good result, but even this operation is dangerous. The establishment of a fistulous opening between the fundus of the stomach and a loop of intestine has afforded considerable relief by lessening the irritation of the growth by the accumulation of food in the stomach.

As to remedies, their chief good influence is in the control of the associated gastric catarrh which is the cause of many of the symptoms. The best results have been secured from the use of *arsenic*, *phosphorus*, *carbolic acid*, *creasote* and *hydrastis*, but clinical evidence does not point to any of them as having a special curative influence over the pathological condition.

Arsenic has apparently arrested the onward progress of cancer of the stomach in many instances. Vomiting is frequent, and the pains are of a burning, lancinating character; indeed, all of the classic symptoms of cancer are found in the symptomatology of this drug, and suggest its continued administration as long as the symptoms do not demand some other course.

Phosphorus is frequently indicated by the symptoms and may afford marked relief from the burning pains and frequent vomiting, the latter occurring soon after the ingestion of food or drink. Frequent

coffee-ground deposit in the vomited matters, and constipation of the peculiar phosphorus type, are symptoms which still further suggest its use. The general character of the phosphorus patient will be remembered. A fresh preparation of the second decimal dilution is most satisfactory.

Carbolic acid and *creasote* undoubtedly ameliorate the gastric symptoms of many cases often to such an extent as to lead the patient to hope for recovery. In one of my cases of cancer of the stomach developing in a woman of sixty-seven years, and attended by tumor, vomiting, pain and frequent slight hæmorrhages, carbolic acid in the first decimal dilution relieved these symptoms, with great improvement in the general health, and at the autopsy, made three years later at an insane asylum where she had died, an atrophic scirrhus, involving the lesser curvature of the stomach, was discovered. There was evidence of previous ulceration. The character of the vomiting is the principal indication for creasote.

Hydrastis is prescribed upon the same indications which call for it in gastric catarrh and other affections of the stomach. Of other medicines employed for cancer of the stomach we may mention *carbo veg.*, *cundurango*, *kali bichr.*, *nux vomica* and *lycopodium*. With *lapis albus* I have no experience. *Nux vomica*, *lycopodium* and *carbo veg.* are prescribed on their well-known indications. *Kali bichromicum* deserves more mention. It exercises a decided influence over the pain, but more especially the vomiting. I have given it in cases marked by heavily coated yellow tongue, or a denuded red and dry one. The vomited matter contained large quantities of ropy mucus. The third to the sixth decimal dilutions were employed.

DILATATION OF THE STOMACH.

Synonyms.—Gastrectasis; gastrectasia.

Definition.—The term "dilatation of the stomach" is largely a relative one, for in estimating its size opinions will differ as to when the normal ends and the pathological begins. A stomach may be abnormally large—actually or relatively to the size of the individual—and yet perform its functions as in health. Such a condition must be regarded as normal, and to it Ewald has given the name "megastria." The term "dilatation" he would limit to those cases of gastric enlargement accompanied by digestive disturbances resulting from that change. Bouchard said that every stomach which did not contract when empty was dilated. Mathieu's definition characterizes a dilated stomach as one which does not empty itself. It seems to me that gastric dilatation may best be defined as an acute or chronic enlargement of the cavity of the stomach resulting in prolonged retention of food and the products of digestion therein.

Etiology.—The pathological causes of dilatation of the stomach are twofold, namely, pyloric obstruction and insufficiency of the gastric walls, *i. e.*, weakness of the expulsive forces. Among the first-named, cancer of the pylorus and cicatricial contraction consecutive to ulceration, also toxic and phlegmonous gastritis, occupy prominent positions. Very rarely it results from a congenital pyloric stenosis, or simple hypertrophy of the tissues surrounding the exit to the stomach. A few cases of obstruction have been reported in which the trouble arose from polypoid tumors in the stomach, these being so situated as to close the pylorus as by a valve. Sometimes the obstruction has been found in the duodenum. How frequently spasm and faulty position of the stomach, *e. g.*, those causing acute bends and twists at the pylorus or in the duodenum, may produce dilatation, is problematical. Spasm of the pylorus undoubtedly exists, but it is exceedingly doubtful if it ever persists to such an extent or for such a period of time as to cause chronic gastric dilatation. Kussmaul has shown, by actual experimentation, that the stomach may assume a position in which the horizontal portion of the duodenum at its points of junction with the stomach is so bent and twisted that an absolutely complete stenosis results. Pyloric obstruction sometimes arises from causes extraneous to the stomach. This is exemplified in some tumors of the pancreas, omentum, retroperitoneal glands and liver. Cicatricial adhesions succeeding an old peritonitis may so contract about the pylorus or duodenum as to interfere seriously with the calibre of these parts. Bartels, Litten, Malbranc and Schutz have called attention to the association of wandering kidney on the right side with gastric dilatation. Bartels regards the stomach trouble the primary one; Osler, Nothnagel and Ewald look upon the associated conditions as a mere coincidence.

Of the causes dependent upon weakening of the gastric muscle, weakening of the muscular tone of the stomach claims first attention. This arises from excessive demands upon it or from changes in its nutrition occurring in certain exhausting diseases, viz., anæmia, neurotic disturbances, peritonitis, diseases of the bloodvessels, and local disturbances, *e.g.*, gastric catarrh. This latter cause is operative because the tardy digestion of food leads to an abnormal accumulation within the stomach. Moreover, decomposition of the imperfectly digested food takes place and this still further increases the distention. Prolonged and repeated distentions finally result in degeneration of the mucous membrane and the muscular layer of the stomach. The muscular weakness in some cases is caused primarily by disease of the nerves furnishing motor power to the same, such a condition arising from local disorder, such as chronic gastric catarrh, or peritonitis. The destruction of the function of a portion of the stomach, as by cancerous infiltration, sometimes results in gastric dilatation.

Pathology and Morbid Anatomy.—The standard capacity of a stomach said to be dilated has been set by Ewald at fifty-three ounces and upwards. Individual cases present great variations. Cadaveric section shows in well-marked cases that the enlarged organ has pushed the neighboring viscera aside. The intestines are forced down into the pelvis and the liver, diaphragm, and spleen, are pushed upwards, the stomach itself occupying the main portion of the anterior part of the abdominal cavity, its lower border extending anywhere from the umbilicus to the pubis; to the latter, of course, in extreme cases only. In cases dependent upon pyloric stenosis the fundus is mainly affected, and the most of the dilatation is observed to the left of the median line. Changes in the walls themselves consist of either hypertrophy or atrophy. When hypertrophied, the gastric walls are found thickened throughout or in patches. Sometimes the thickening depends upon an overgrowth of the muscular coat; in others, upon a diffused infiltration of the stomach with cancerous elements. Sometimes the muscular hypertrophy is observed principally at the pylorus. The hypertrophic form of dilatation is found in young subjects. The atrophic variety, which sometimes occurs as a continuation of the hypertrophic, is observed generally in old people. The mucous membrane usually exhibits the changes characteristic of chronic gastritis. Very often the glandular cells are degenerated; they are forced apart and the space between them is filled with connective tissue.

Symptomatology.—Occurring as a secondary condition, *e.g.*, those cases resulting from pyloric stenosis, dilatation of the stomach presents no especially characteristic symptoms excepting the vomiting and the physical signs to be hereafter described. Other cases are marked by the very gradual onset of symptoms, which, for the most part, consist of the ordinary phenomena of indigestion, viz: coated tongue, eructations of offensive gas, bad breath, distention of the epigastrium after eating, epigastric tenderness, malaise, headache, nausea, vomiting and constipation. Of the above-mentioned symptoms the vomiting is the most important, being rarely absent. In the early course of the disease it takes place immediately after eating. As time goes on the vomiting becomes less frequent owing to the increasing relaxation of the gastric walls. The accumulation of ingesta becomes correspondingly great, so that when vomiting does occur the quantity ejected is truly surprising, as high as seventeen pounds having been said to have been vomited at one time. Sometimes the vomiting, after continuing for a long time, with increasing severity, suddenly ceases. This is generally an unfavorable symptom, for it may be due to the removal of the pyloric stenosis by ulceration, or the pylorus has lost all contracting power. Examination of the vomited matters reveals substances which must have been eaten several days before. The quantity ejected represents, therefore, the accumulation of

several meals. Ewald has called attention to the characteristics of the vomit when put into a cylindrical glass to subside. It will be found to separate into three layers, "the upper one of brownish foam, a much larger middle layer of yellowish brown, faintly cloudy fluid, and a lower one consisting of dark-brown, crummy and slimy masses, chiefly remains of food. From time to time bubbles of gas rise up through the fluid, carrying particles of the deposit with them, while other fragments sink, since they are no longer supported by the carbonic acid gas." The odor of the mixture is generally offensive and its reaction acid. The particles of food contained are softened and in a partially digested state. Microscopic examination discovers the presence of numerous micro-organisms, notably yeast fungi, bacteria and sarcinæ ventriculi. Experimentation by DuBarry has not assigned to any of these any definite effects. We are forced to conclude that their presence in any large numbers is pathological, however, for they are associated with marked disturbances of the gastric functions.

The chemical constitution of the gastric juice in dilatation of the stomach will depend in great measure on the nature of the primary disease. When the primary affection is a pyloric cancer, free hydrochloric acid will not be found. In other cases, hydrochloric acid exists in normal or slightly diminished quantity and sometimes it is even increased.

Fermentation within the stomach is very common, sometimes with the evolution of lactic, butyric and acetic acids, and in other cases, of gases, *e. g.*, carbon dioxide, sulphuretted hydrogen, nitrogen, hydrogen, and oxygen.

As a rule the motor and absorptive functions of the stomach are lessened. Still this is not invariably the case, for examples of marked dilatation have been observed in which there was not the slightest impairment in either of the above-named particulars.

The bowels are usually constipated, probably because of the lessened quantity of digestive products escaping by way of the pylorus, also from weakened intestinal peristalsis. Exceptionally, diarrhœa occurs.

The urine presents no characteristics requiring especial mention. The statement that it is persistently alkaline seems to be based upon a study of cases not thoroughly treated, for in all instances in which lavage has been practised regularly, an acid reaction was the rule.

General nutrition does not fail until the disease is well advanced and vomiting extreme. At the same time the decomposition of the products of maldigestion becomes more and more evident; the breath is foul to the highest degree; eructations are putrid, and flatulence is marked. The accumulated flatus, by its pressure on neighboring organs, notably the heart, produces quite distressing symptoms, such as dyspnœa and palpitation. The bowels become even more constipated

than before, and can be moved only by mechanical or medicinal assistance. Anæmia and exhaustion steadily increase and even a marantic œdema may develop. The skin is abnormally dry and covered by minute scales. Peculiar nervous phenomena first described by Kussmaul, and apparently of the nature of tetany, develop in some cases. These show themselves by nystagmus, emprosthotonos, spasms of various muscles, etc. These attacks have been attributed by Kussmaul to the dehydration of the tissues, as in cholera. Gerhart believes they are due to the absorption of decomposed digestive products. Some cases terminate in coma, bearing a close symptomatic resemblance to diabetic coma. This is said to depend upon diacetæmia.

Physical Signs.—Inspection. The information given by inspection must depend in great measure on the condition of the abdominal walls. When these are thin and relaxed, there is a bulging over the left hypochondriac region, the epigastrium, and at times some over the right hypochondrium. The shape of this distention is often suggestive of its gastric origin. It begins just below the free end of the tenth rib, and curves downward and to the right, the lower border crossing the median line at or below the level of the umbilicus. Sometimes this bulging assumes a very low position, while above it is a depression which Ewald describes as trough-like. Its existence has received two explanations, namely, that it is dependent upon the assumption of a vertical position by the long axis of the stomach, or the region of the lesser curvature becomes collapsed while the fundus itself is distended with ingesta. Sometimes the distention along the lesser curvature is visible. In cases in which the distention above described is not visible, it may be brought into view by inflating the stomach by methods already described (see page 540). Sometimes this operation is not successful, either because of the quantity of gas evolved being disproportionately small to the gastric capacity, or because of an unusual patulency of the pylorus. Peristaltic waves travelling from left to right are not uncommon, especially in cases dependent upon pyloric obstruction. Sometimes antiperistaltic waves from right to left are observed. These movements become especially prominent from external mechanical irritation.

Percussion. The successful practice of percussion in gastric dilatation is only certain when the stomach has been artificially distended by air. The percussion note over the organ will be found to be tympanitic and of high pitch. It may happen that the adjacent transverse colon may give exactly the same sign, rendering the distinction of the boundaries of the two parts impossible. The difficulty thus encountered is to be overcome by directing the patient to drink a certain quantity of water, say from one to two pints. Then perform percussion once more; the ower limits of the stomach will be shown by an area of dulness obtainable only when the patient is in a standing position. Ewald believes

that auscultatory percussion gives better results than does the ordinary method. The investigations of Pacanowski give us a standard by which we can make practical application of the information obtained by percussion. He finds the lowermost limit of the healthy stomach, in men, to be from one and one-fifth to two inches above the umbilicus; in women, from one and three-fifths to two and four-fifths inches. The vertical variation from normal gastric tympanites was found by the same observer to be from four and two-fifths to five and three-fifths inches in men, and four inches in women. The width of the zone was found to be eight and two-fifths inches in men, and seven and one-fifth inches in women. Departures from these standard figures are allowable within moderate limits as compatible with health.

Palpation. Leube's recommendation that a stiff sound be introduced into the stomach and its extremity palpated from without is impracticable. A vertical position of the stomach may cause the instrument to take a lower position in a normal organ, while in other cases the tip may be caught in a fold of mucous membrane. Even then, if the abdominal walls are at all thick, the tip of the sounds can only be recognized by palpation with the greatest difficulty, if at all.

Auscultation. The employment of auscultation in the diagnosis of dilatation of the stomach resolves itself into the investigation of succussion sounds and the discovery of a hissing sound arising from fermentation. The succussion sounds or splashes are obtained by placing the hand flat on the region of the stomach and giving the part a series of shocks. They are normal when they occur in the stomach immediately after the ingestion of food or drink, and in the colon. That they are positively produced in the stomach may be determined by siphoning the stomach, which, unless they are produced in the colon, will cause them to disappear. In patients with a dilated stomach the heart-sounds may be sometimes distinctly heard over the epigastrium, though of a metallic character.

A method of examining the stomach by auscultation has been proposed by Rosenbach and is mentioned here for the sake of completeness, for it does not seem to be one of practical clinical value. Water is poured into the stomach. Next air is blown through the tube with the point beneath the surface of the water. Now, auscult, the tube being slowly withdrawn. Auscultation enables us to say just at what moment the tip of the tube leaves the water and so indicates the level of the fluid. If now more water is poured in and the experiment conducted as before, the level of the water becomes higher in the case of a normal stomach; in the case of a dilated one, very little additional displacement will occur.

Mensuration is of use only in determining the capacity of the stomach by means of the quantity of water which the stomach is capa-

ble of containing during lavage, or by the amount of ingesta vomited at one time.

Diagnosis.—The symptomatology of gastric dilatation, as already detailed, has furnished the phenomena on which we must rely for the recognition of this condition. It is only necessary here to direct attention to the character of the vomiting and of the vomited matters, the physical signs, and the deficient motor power of the stomach. Unfortunately no one symptom can be regarded as conclusive. An opinion is to be formed only after a consideration of the *tout ensemble* of the case.

Prognosis.—The prognosis of dilatation of the stomach depends entirely upon the cause of the trouble. Those resulting from cancer of the pylorus must be regarded as absolutely hopeless. Cases caused by cicatricial stenosis offer an unfavorable outlook if the obstruction is irremovable. Those arising from changes in the gastric walls present a more favorable outlook, although they are very obstinate under treatment. All cases of whatever character are capable of great amelioration under proper dietetic, hygienic, mechanical and medicinal measures.

Treatment.—The most important point in the treatment of gastric dilatation is lavage, directions for the performance of which have already been given (see page 544). The operation should be repeated daily, and the greatest care exercised to see that the washing is continued until the stomach is thoroughly cleansed of the fermenting mass of food. The use of antiseptic solutions is valueless, and therefore not to be advised. One can do as well with a simple alkaline solution or artificial Vichy water. The time selected for the operation should be as far removed from meal-time as possible. The washing should always be followed by the ingestion (through the tube) of a small quantity of easily digested food, *e. g.*, peptonized milk, rich broth, etc.

The diet prescribed should contain as little fluid as possible. Alcoholic beverages of all kinds, but especially those containing any gases, tea and coffee, must be positively forbidden. Milk, if ordered, must be administered in small quantities (one ounce) at short intervals. The objection to fluids is found in the distention of the stomach which they cause, and the fact that they favor fermentation. Many artificially prepared foods in powder form, such as peptones, etc., are to be recommended. Starchy and saccharine foods are to be taken with the greatest care, if at all. Fatty articles must be forbidden, for they are not digested and only serve to irritate the gastric mucous membrane. When the patient is unable to take sufficient food to maintain a proper standard of bodily strength, his diet may be supplemented by nutrient enemata.

Faradization and massage are valuable adjuvants. Faradization may be either external or internal. The latter, though the more disagreeable of the two, offers the better results. For this purpose quite a

variety of gastric electrodes have been advised, of which those presenting a straight outline like the stomach tube are the best. The current is made to reach the entire lining of the organ by first introducing a quantity of water (one quart). The external electrode is placed over the epigastrium. In the external method one electrode is placed over the epigastrium and the other over the pneumogastric in the neck, or over the spine on a level with the epigastrium. The applications should be made daily.

Massage is valuable and should be performed only by a skilful masseur. It acts beneficially by forcing the stomach contents through the pylorus and by improving the nutrition of the organ. Care must be taken lest the stomach contents be acrid and irritating, for if in this state they enter the duodenum, they can readily produce some mischief.

In intractable cases caused by stenosis of the pylorus, arising from other causes than malignant diseases, the propriety of excision or dilatation of the pylorus should be seriously considered. Medicines exercise little influence even upon the primary disease. For suggestions, reference must be made to the articles on cancer, catarrh, etc., of the stomach.

HÆMATEMESIS.

Hæmatemesis and hæmorrhage from the stomach are ordinarily regarded as synonymous terms. It must be remembered, however, that the blood vomited may have escaped from the intestines into the stomach, or have been originally effused in the upper portion of the alimentary canal and swallowed.

Etiology.—Hæmatemesis must be regarded as a symptom and not as a disease. In treating of its etiology one must deal almost entirely with pathological factors. In previous sections stress has been laid on the importance of gastric hæmorrhage as one of the symptoms of cancer and ulcer, but particularly of the latter. These, however, are not the only causes of the accident. Thus it has arisen from traumatism both from without and from within. Of the former there are blows and penetrating wounds; of the latter, punctures by sharp-edged foreign bodies swallowed with the food, the ingestion of hot or corrosive substances, awkward intra-gastric instrumentation, and severe injury, such as may be received, *e. g.*, at football or in a railroad accident.

Some cases are caused by disease of the bloodvessels of the stomach, diseases which differ in no particular from conditions observed in other portions of the body, and which have been described in the section on diseases of the vascular system. Miliary aneurisms can occur here as well as in the brain. In some cases the veins are found diseased, being degenerated or actually varicose. In the latter case there is usually an associated passive congestion of the stomach. In still other

cases the arteries are found to have undergone fatty, amyloid, or atheromatous degeneration.

Some cases of gastric hæmorrhage are purely congestive in origin, this hæmorrhagic congestion being either active or passive. Active congestion is usually inflammatory in origin, the inflammation still further tending to the production of hæmorrhage by producing degenerative alterations in the vascular walls. Belonging to this class of cases of active congestion of the stomach are those cases of hæmatemesis which take place at the menstrual periods, seeming, indeed, to supplant the natural flux. Passive congestions of the stomach may be the result of disease of the portal circulation, changes in the pulmonary circulation dependent upon various affections of the respiratory apparatus as emphysema, pleurisy and fibroid phthisis, and uncompensated valvular and other diseases of the heart.

Reference to the first volume of this work will show that quite a variety of the acute infectious diseases have hæmatemesis as a prominent symptom in severe cases. Deserving of especial mention in this particular are yellow fever, relapsing fever, typhus, cholera, diphtheria, erysipelas, smallpox, measles and scarlet fever. The cause of the hæmorrhage in these cases is probably blood disorganization and vascular degeneration.

Hæmorrhage is a symptom of the anæmias, and is as liable to involve the stomach as it is other organs. Thus we find hæmatemesis a symptom in chlorosis and in the malarial cachexia. It sometimes occurs in other blood diseases, as hæmophilia, scurvy and purpura.

The hæmatemesis attending Bright's disease is caused by the increased vascular tension, by the blood changes and by the alterations in the structure of the walls of the smaller bloodvessels.

Disease in neighboring structures, *e. g.*, abscess, extends to the stomach and sometimes causes hæmorrhage.

There is remaining a class of cases for which no cause is discoverable either during life or at the autopsy. Such cases have been called idiopathic. As knowledge increases they must be relegated more and more to the background, until at last such a class will not be recognized.

Pathology and Morbid Anatomy.—The above remarks concerning the etiology of hæmatemesis indicate pretty fully the pathology of the accident. When the bleeding occurs from a ruptured vessel the discovery of the offending spot is not usually a difficult matter. Sometimes, however, it is from such a minute vessel that the most painstaking examination is necessary. Cases in which the blood escapes by diapedesis are not infrequent, but the hæmorrhage is not likely in such cases to be so profuse as to cause death. Hence autopsies on these cases are seldom held.

Symptomatology.—The characteristic symptom of hæmorrhage

from the stomach is the vomiting of blood. This is usually dark in color, often clotted, and of acid reaction. In cases in which the trouble is slight, there may be no evidence of its occurrence even in the stools.

Diagnosis.—The changes developed in the blood by the action of the gastric juice sometimes makes its recognition difficult. The oxyhæmoglobin is converted into hæmatin, giving the blood the appearance of coffee-grounds. The hæmatin may be recognized by Teichmann's test. The suspected substance must be dried, powdered, and placed upon a slide. Next a crystal of common salt is added and the whole covered by a cover glass, beneath which a few drops of glacial acetic acid are made to flow. The preparation is now heated to a point below that of boiling, and in a short time the hæmatin will be visible under the microscope as brown rhombic crystals.

Ordinarily there should be no difficulty in differentiating hæmatemesis and hæmoptysis. If there is any doubt it may be dispelled by the data furnished in the article on the latter subject (see page 296).

It is not always so easy to decide between intestinal and gastric hæmorrhage. One must here be guided by the history of the case and the associated conditions.

Cases in which the bleeding has taken place from the mouth, nose or throat, and the blood swallowed, are to be recognized by inspection of these parts.

In one of my cases of simple ulcer of the stomach, death occurred without an external show of blood, but the stomach and small intestines were filled with blood, and much had passed into the colon.

Hysterical women and malingerers sometimes swallow the blood of an animal and then vomit it, the trick being done to accomplish some selfish purpose. The associated symptoms of a profuse hæmorrhage are absent in these cases. The microscope will sometimes enable us to say that the corpuscles are not those of human blood.

In infants the vomited blood is frequently taken from the mother's nipple. This fact need only be mentioned to prevent error.

Prognosis.—A fatal result from gastric hæmorrhage is very rare. Still it does occur, especially in cases resulting from ulceration, cirrhosis of the liver and aneurism. Of course, much depends upon the previous state of the patient's health.

Treatment.—The most important measure in the treatment of hæmatemesis is general and local rest. The patient should be put to bed and not permitted to rise under any circumstances. The room should be cool, the bed-covering light, and every effort made to quiet excitement on the part of the patient. Food must not be allowed to enter the stomach, rectal alimentation being substituted. Pieces of ice may be administered by the mouth, and an ice bag should be placed over the epigastrium, but its influence requires watching, as too pro-

longed cold may cause feebleness of the heart. The administration of styptics is absurd, as they cannot be given in doses sufficient to exert a sufficient degree of action, and, moreover, may produce nausea and vomiting, the particular thing it is so important to avoid.

Ipecacuanha possesses a long-standing reputation in the treatment of hæmorrhage from the stomach, and appears to have been employed successfully for hæmorrhage dependent upon almost any pathological condition. I find it possessing little influence over that due to blood changes. It is a good routine medicine to give upon first seeing a patient, and while determining the cause and best plan of treatment of the bleeding. The first decimal dilution is the most satisfactory preparation. *Aconite* is preferable if the subject is young and plethoric and evinces considerable excitement and fear. *Arnica* is much recommended for hæmorrhage due to traumatism, but I am inclined to believe that this is one of the traditional indications for medicines, of which we have so many, and that arnica is really of little value in these cases. *Turpentine* is much more efficient, and an admirable remedy even for hæmorrhage associated with some organic diseases. The first decimal dilution on sugar or disks should be freely used. I am disposed to give this remedy after ipecac., if indications for another medicine do not arise.

Cinchona is valuable for the consequences of hæmorrhage.

The influence of *hydrastinine hydrochlorate*, in the second decimal trituration, upon hæmorrhages from the bowels, nose and other mucous surfaces, suggests its possible value in hæmatemesis. In urgent cases it may be given hypodermatically in doses of an eighth to a quarter of a grain. Many advise *ergotine* under these circumstances. My experience with this remedy has not been very favorable.

If bleeding continues in spite of these means, and with failing circulation, stimulants must be employed by the rectum, ammonia applied to the nostrils, and ligatures about some of the limbs near to the body to diminish the free return of venous blood to the heart. If in spite of these measures failure continues, intravenous injection of normal salt solution or transfusion of blood should be tried. There are cases in which it is justifiable to perform abdominal section, discover the bleeding point and resect or do what other operation may be found indicated.

In a general way it may be stated that passive congestion calls for *digitalis, hamamelis, arnica* or *pulsatilla;* traumatic cases for *hamamelis, arnica* or *rhus tox.;* inflammatory cases for *aconite* or *belladonna;* those associated with a high degree of vascular tension for *aconite* or *glonoin;* when nausea is a prominent symptom for *ipecacuanha;* scorbutic cases for *arsenicum*, the *mineral acids* or *phosphorus;* when blood changes predominate, as in yellow fever, typhus, etc., for *crotalus, lachesis, arsenicum, phosphorus, secale* or *turpentine;* in patients with hæmophilia for *phos-*

phorus and *lachesis* especially; when there is vascular degeneration for *phosphorus*, *arsenicum* or *glonoin*; when the passive congestion is due to uncompensated cardiac disease for *digitalis*, *glonoin*, *strophanthus* or *convallaria*; vicarious hæmorrhage for *bryonia*, *millefolium* and *pulsatilla*.

GASTRIC NEUROSES.

GASTRALGIA.

Synonyms.—Gastrodynia; neuralgia of the stomach; cardialgia.

Definition.—An affection characterized by severe paroxysms of pain referred to the epigastrium, usually appearing suddenly, and dependent upon irritation of hyperæsthetic sensory filaments of the pneumogastric nerves.

Etiology.—The causes of gastralgia may be divided into (1) the constitutional, illustrated by cases attendant upon anæmia, neurasthenia, psychoses, climacteric disturbances, etc., and (2) the central, as exemplified in the gastric crises of locomotor ataxia. The definition above given excludes from the category of gastralgia the severe pains produced by ulcer, cancer, and other organic diseases of the stomach. Gastralgia is not infrequently caused by a hypersecretion of hydrochloric acid, but this of itself is a neurosis and is dependent upon the usual causes of the neuroses generally. Such a case cannot, therefore, be regarded as possessing a local origin. Women are affected with gastralgia far more frequently than are men, because they are the more subject to neurotic disorders generally. Excessive indulgence in certain articles of food or drink is the cause in some cases. Tobacco, tea and coffee deserve especial mention in this connection.

Symptomatology.—Gastralgic attacks occur in paroxysms, which appear more or less suddenly. They often develop without assignable cause, and ofttimes with some periodicity. Sometimes the attacks are ushered in by a sense of discomfort, or a feeling of fulness and tension in the epigastrium. Some cases are preceded by peculiar symptoms referred to other portions of the body; thus one author has reported salivation and another toothache as pre-paroxysmal symptoms. The former I have observed. In all cases the pain increases rapidly in intensity, and is soon of a sharp, boring character, sometimes limited to the epigastrium, and in others radiating over the entire abdomen. Sometimes it partakes of the well-known girdle sensation. The patient is ofttimes obliged to bend double for relief, and all movements necessitating the slightest action of the abdominal muscles are instinctively suppressed. There may be marked hyperæsthesia of the epigastrium to the slightest touch, while firm pressure brings relief. The attacks appear without regard to the time of taking food; indeed, the pressure of food in the stomach seems to give relief in some cases. The severity of the

pain is sometimes such as to produce marked general evidence of the suffering; thus, the face becomes pinched and haggard, the pulse quick and feeble, and the entire body bathed in a profuse, clammy perspiration. Even unconsciousness may ensue. Attacks subside either slowly or rapidly. After lasting all the way from a few hours to a couple of days, the paroxysm may end with a critical discharge, as violent vomiting or profuse urination, the urine being of low specific gravity. It generally leaves the patient much prostrated.

The paroxysms dependent upon organic disease of the central nervous system are caused by sclerotic changes about the nucleus of the pneumogastric nerves. They occur at very irregular intervals. Buzzard has called attention to their frequent association with the joint lesions of ataxia. Their true character is very apt to be overlooked, because with very few exceptions, they are observed in the early stages of locomotor ataxia when the classical symptoms of that disease have not yet developed. Gastric crises are apt to be attended by vomiting. They are remarkable for the suddenness with which the pain may cease.

Diagnosis.—To establish a diagnosis of gastralgia it is essential to exclude all painful organic diseases of the stomach. This is to be done mainly by physical exploration, which gives negative results. To further strengthen the diagnosis of gastralgia one must consider the history of the case. In ulcer the pain is aggravated immediately after the taking of food; no such modality is observed in gastralgia, in which condition the pain may occur at any time after eating, and may even be relieved by the taking of food into the stomach. In both cancer and ulcer the pains appear with greater frequency than in gastralgia. In cancer they are almost constant, and in ulcer they are prone to recur several times in the course of a day. Gastralgia occurring as a symptom of hysteria, neurasthenia and anæmia is recognizable by the conditions significant of those troubles.

The true nature of the gastric crises of ataxia may be discovered by finding the patellar tendon reflexes absent, and discovery of the existence of the characteristic ataxic lightning pains in various portions of the body. In some cases static ataxia and arthropathy make the diagnosis very plain.

Prognosis.—The prognosis is favorable in nearly all cases. Constitutional treatment directed to the neurotic state of the patient brings about a cure within a period varying according to the severity of the case.

Treatment.—General hygienic and dietetic measures must be first instituted. It is a common observation that attacks are developed by unusual exercise or excitement; *e. g.*, a shopping trip is a common precedent of a violent attack. The patient should be fed, as a rule, on highly nutritious and easily digested food as directed in the articles on anæmia and hysteria. Eating when exhausted should be carefully

avoided, and a little period of rest after each meal is highly beneficial. In very obstinate cases in which the neurotic element is very marked it may prove necessary to put the patient on a systematic course of "rest treatment." In nearly all cases it is best to direct the patient to take an hour or so of absolute rest in recumbency each day, preferably after the noonday meal. During the paroxysms food should not be allowed unless the pain is of long duration, and then only of the lightest liquid character.

Nux vomica is particularly adapted to intellectual individuals of sedentary habits who are subject to constipation, and in whom the disease has been caused by excessive mental work, irregular eating, excesses in tobacco, alcohol, tea or coffee. The attacks are particularly apt to appear in the morning, and may be excited by the use of solid food. The pains are of a griping, clawing character and extend in all directions, even to the back. There is nearly always a high degree of gastric irritability present, and active movements of the stomach walls may sometimes be seen or be discovered on palpation. There is therefore an element of spasm. The nux patient is often quite well supplied with blood, and aside from his gastralgia, constipation, etc., would be fairly well. *Strychnine,* in tablets of the second decimal trituration, is an admirable remedy during the intervals existing between the gastralgic attacks if the patient is feeble, has little appetite, is dyspeptic and constipated.

Arsenic occupies the first place for gastralgia occurring in the anæmic and enfeebled. The pains are of a burning character and radiate in various directions. The symptomatic indications for this remedy are very numerous. The third to the sixth decimal triturations are usually satisfactory, but failing with these, Fowler's solution may be given in doses of one to three drops several times daily. These larger doses are sometimes successful when the smaller ones have failed. I have of late employed the *arsenite of copper* for these cases with a great deal of satisfaction. If given in the early stage of the attack it will frequently abort the severe pain. It is also an admirable remedy for the dyspeptic symptoms from which many of these subjects suffer. It is particularly the neurotic type of dyspepsia that is controlled by this remedy. Its close relationship to disorders of the nervous system is not generally understood. The second decimal trituration has given the best results.

Belladonna or its alkaloid *atropia* is useful in cases of gastralgia of a purely nervous type and characterized by the suddenness with which the paroxysms appear and disappear. *Argentum nitricum* is advisable for the gastric crises of locomotor ataxia, although belladonna is also frequently indicated in that class of cases. The silver nitrate is also adapted to weak delicate women in whom the paroxysms are

brought on by slight emotional influences. The pains are of a gnawing character and characterized by slowness of onset and departure. The pain is greatly aggravated by food, although firm pressure or bending double gives relief. I have found this remedy more useful in persons who during the intervals suffer from dyspeptic symptoms with excessive eructations. *Veratrum album* is useful when symptoms of circulatory failure result from the intensity of the pain. *Hydrocyanic acid* I have used but little. Hughes commends it "where there is a distressing 'sinking' complained of and where the pain is temporarily relieved by food."

Iris cured one of my cases which had resisted many remedies for several years. The pain was very distressing, came on frequently, extended from the epigastrium to the back, but was never very intense. There was no nausea or vomiting, but migraine, for which the remedy was prescribed in the third decimal dilution.

When gastralgia is associated with uterine disorders, *sepia*, *pulsatilla*, *zinc*, *cuprum*, *ignatia* and other remedies related to the sexual organs of women, or to their neurotic groups, are most serviceable. *Cocculus*, *cuprum*, *manganese*, *plumbum*, etc., are also recommended by various observers.

In some cases the pains may be so severe and so persistent as to call for palliative medication. This should be resorted to with the greatest reluctance. In the first place, the use of *morphia*, if at short intervals, increases susceptibility to pain, and in the second place in patients of a neurotic constitution may readily lead to the morphia habit if the remedy is put into their hands. If morphia is used it should be given or injected only by the physician or an attendant, and at the earliest moment possible. By this method I have recently cured a case of several years' standing which had defied all treatment. The very early administration was the important feature. This case is cited to illustrate an exception to a general rule. After the attacks were developed morphia, even in large doses, had little and often no influence. The administration of cocaine by the mouth to benumb gastric sensibility, as recommended by Ewald and Osler, is to be condemned.

Some cases will receive great benefit from electrical treatment. Galvanism is the preferable current. The positive electrode should be a large flat one and placed over the epigastrium, while the negative is placed over the mid-dorsal spine or over the pneumogastric nerves in the neck. It may be used as a palliative during the seizures, and in the inter-paroxysmal periods as a curative measure.

NERVOUS DYSPEPSIA.

Synonyms.—Gastric neurasthenia; neuro-muscular dyspepsia; atonic dyspepsia.

Definition.—Nervous dyspepsia is a clinical condition in which

various morbid subjective phenomena suggestive of disordered digestion referred to the stomach appear, usually independently of any discoverable gastric lesion, and caused apparently by purely nervous influences.

Etiology and Pathology.—A study of the causes and pathology of nervous dyspepsia is greatly hampered by the difficulty in deciding what should and what should not be included under this title. From a strictly theoretical standpoint only such cases as are unattended by local objective changes and in which the phenomena are of purely neurotic origin, should be so considered. But improvements in our methods of research demonstrate that many cases hitherto regarded as pure gastric neuroses are more properly included under other heads. Thus one author discovered in a series of cases that a large number showed degeneration of certain nerve plexuses; and Ewald and others have proven the existence of marked disturbances in the chemical functions of the stomach. Even the cases which we must still believe to be neurotic in origin present wide differences in clinical types, differences so great, indeed, as to ofttimes lead an astute clinician to doubt their similarity in origin. The difficulties in the study of the subject are still further enhanced by the nervous disturbances which so frequently accompany purely gastric lesions; nervous symptoms arising either as reflex phenomena or from the effect on the nervous system of the toxæmia produced by the products of imperfect digestion. Prominent among these phenomena are evidences of mental depression, which are common in gastric disease of any kind. Then we meet with cases in which the nervous symptoms are primary, the fault resting with the central nervous system, as exemplified in the vomiting of cerebellar disease and the crises of ataxia. No wonder, then, that Ewald likened the study of nervous dyspepsia to "trying to grasp a medusa which is dissipated in our grasp."

In many cases the trouble in its early stages is strictly neurotic. Long continuance leads to objective changes. Thus, the local neural weakness means defective innervation of the muscular coat of the stomach, and that in turn leads to atony. Next succeeds disturbances in the digestive function, the retention of food in the stomach for a prolonged period, dilatation of the stomach, changes in the gastric juice, fermentation, flatulence, etc. One must not, therefore, be too positive in assuming that a case which was undoubtedly neurotic in the beginning has remained so.

A neurotic constitution, either inherited or acquired, is the main etiological factor of nervous dyspepsia. Investigation discloses that the subjects of this disease exhibit numerous symptoms, and more often than not, can give a history of insanity, neuralgia, hysteria, or other functional nervous affections, in their ancestry. Such subjects, too, are very often members of the higher walks of society—persons whose nervous systems have been developed at the expense of the physical.

Some of them have still further intensified the effects of neurotic inheritance by their modes of life. Thus they cultivate indolent habits, pursue no settled object for occupation, living only to study self and self-gratification. Such a combination is, of course, highly unfortunate, each of these etiological factors greatly intensifying the influence of the others.

In other cases, there is acquired fault with the nervous system. Originally the patient may have been of fairly robust health. But under the influence of a praiseworthy ambition, he has exerted himself beyond the bounds of reasonable endurance and his nervous system succumbs. The stomach likewise suffers; sometimes alone, because it happens to be the *locus minoris resistentiæ*, and sometimes in conjunction with other viscera.

Diet is an important etiological factor, acting, however, in different ways, according to the case. In many the quality or the quantity of the food is inadequate to the demands of the subject's labors. This virtual starvation is frequently the result of a morbid introspectiveness, leading to injudicious care in dieting, so that one article after another is banished from the diet list, until finally, nothing but the simplest,—and these often not of a nourishing quality,—remain. It is altogether too common an error to believe that the mental worker requires but little food. On the contrary, his demands are as great as the athlete, but the quality must be better selected. It is important, moreover, that he indulge in suitable exercise, without which normal digestion and assimilation are greatly endangered in the strong, and impossible in the frail.

The other extreme, the taking of too much food, is sometimes observed. In many of these cases unsuitable quality as well as the excessive quantity brings about neurotic gastric symptoms increased through the intervention of a resulting lithæmia.

Clinically, then, we cannot ignore the influence of dietetic transgressions in the production and aggravation of so-called nervous dyspepsia. However clear may be the neurotic origin of the trouble, the possibility of a hybrid pathological state must always be borne in mind. A chronic gastric catarrh occurring in a neurotic patient must have impressed on its clinical picture many if not all of the phenomena of a nervous dyspepsia.

A common class of dyspeptics, which do not seem to have a close clinical relation to the cases under consideration, are the many patients whose cases cannot be diagnosed any more accurately than by the appellation "weak stomach." They get along tolerably well if they pursue an even life, eating so much of a certain limited variety, and not working beyond their capabilities. Many of them are of phthisical habit, others are the subjects of chronic heart lesions, and still others are subjects of what may, for want of a better name, be regarded as a general visceral weakness.

It has already been stated that the clinical picture of neurotic dyspepsia varies according to the case. Attempts at classification of types have not been as satisfactory as one would wish. For convenience we may regard cases as exhibiting phenomena of irritation and phenomena of depression. These of course relate to the symptoms manifested. There are cases, too, in which the disturbance is of the motor function, which may be either excessive or diminished. In some, secretion is disturbed, the hydrochloric acid of the gastric juice being increased or diminished, generally, however, the former.

The pathology of strictly neurotic cases may be summarized as consisting of a morbid irritability of the nerves of the stomach, arising usually from cerebral influences, and this leads to the production of discomfort of different kinds and degrees in response to even normal stimulation.

The symptoms are assigned by different authors to a variety of factors. By many they are regarded as due to mental operations, *i. e.*, imaginary ailments, because they cease when away from home or when the patient's mind is kept occupied. Some believe they are due to an auto-intoxication, others regard them as the result of enteroptosis, and still others look upon them as evidences of reflex irritation arising from diseases of distant or adjacent organs.

Symptomatology.—From what has been said the difficulties surrounding a description of the symptoms of nervous dyspepsia will be readily appreciated. The ordinary type of cases gives a history of general nervous conditions together with sensations of fulness in the epigastrium after eating. This is usually relieved by eructations of tasteless gas, and is often associated with feelings of great distress and anxiety, and even with palpitation. Sometimes the paroxysms thus described occur at night, arousing the patient from sleep, and because of the circulatory disturbance, numbness of the extremities and other associated pnenomena occasion the greatest alarm. The severity of the attack loses nothing in its portrayal by the patient or the friends. It is usually stated that the attack has been brought on by an indiscretion in diet, but careful questioning shows that just as frequently as not it has resulted from some other influences; very often, indeed, by the nerve wear and tear of unusual care and exertion.

Variations from the above symptomatic totality are often puzzling to the inexperienced. Thus, in one of my cases, the accumulation of flatus was accompanied by what the patient said was an intense brachial neuralgia. This disappeared promptly on the expulsion of the flatus. In other cases the symptoms follow petty worries and cares.

The state of bodily health and nutrition of nervous dyspeptics varies as do other symptoms. Some patients are the picture of robust health; some are abnormally stout, and still another class will be found anæmic,

thin and scrawny. In many of the anæmic cases it is not an easy matter to determine whether the dyspepsia or the anæmia is the primary condition. Undoubtedly in very many the imopverished blood state must occasion starvation from defective nerve and blood supply to the stomach, and thus give rise to local distress. In others the gastric disturbance may occasion imperfect tissue changes, with resulting anæmia.

In the majority of nervous dyspeptics the bowels are constipated. Sometimes there is evidence of intestinal indigestion. Exceptionally we find a history of neurotic diarrhœa, brought on by every slight emotional influence. It is not unusual to find mucus in the stools. In some of the cases this symptom is due to the direct irritation of hardened fæces. In others it is evidence of perverted secretion, which itself results from imperfect innervation of the intestines. To diagnose such cases as strictly catarrhal is rarely justifiable.

Diagnosis.—The diagnosis of nervous dyspepsia depends upon the presence of the characteristic symptoms above described, together with the failure to discover objective phenomena belonging to other recognized gastric disorders. This last qualification is an important one. It makes the diagnosis rest upon negative evidence. Positive evidence of other actual lesions outweigh all indications of a pure neurosis. One must also bear in mind that there is hardly a symptom referred to the stomach which may not be the result of neurotic dyspepsia. One patient may complain of constant epigastric soreness; another of nausea; still others may have vomiting. Of great diagnostic value is the liability of the symptoms to disappear and appear under pleasant and unpleasant emotional causes respectively. In searching for objective causes of gastric symptoms, the entire body must be examined. Diseases of the brain and spinal cord, lungs, heart, bronchi, liver, intestines, female genitals, etc., may one or all be the *fons et origo mali.*

Prognosis.—No class of cases offers a more uncertain prognosis than do the neurotic dyspeptics. As a rule it may be said that such patients always retain their infirmity, usually, however, because of their voluntary bondage to their weakened nerves. One might almost say that many of them hypnotize themselves into illness. Given a reasonable patient, however, one who will let the management of the case rest with the physician, who will stop worrying over the symptoms, and the outlook is favorable. It is very rarely indeed that these cases result fatally; they are far more apt to wear out the unfortunate friends and family of the patient. There are some exceptional cases in which vomiting appears as a neurosis and is very resistent to treatment, some few of them ending fatally. Such cases are, however, rare, and must be regarded as clinical curiosities.

Treatment.—The first element in the treatment of nervous dyspepsia is a thorough investigation into the facts of the case, *i. e.*, obtain

an accurate history and make a thorough physical examination to determine the presence or absence of objective conditions. This done, one is on a reliable foundation as a starting point. Next, the patient must be given to understand the true state of affairs, and the proper course of treatment carefully mapped out. In this as in other gastric disorders the question of diet becomes an important matter. As a rule strict dietary precautions are not needed; indeed they are often harmful. To have the patient constantly worrying over what to eat and what to avoid only intensifies the introspectiveness. On the other hand, rich and notoriously indigestible articles must be avoided. Here, again, we must exercise judgment, for have we all not met with patients who can partake freely of viands which would tax the stomach of an ostrich, and yet who succumb to simple plain food. We might say that the diet should be sufficient in quantity and varied in character and readily digested, so that the proper standard of bodily nutrition can be maintained. Its quality should be of the kind best calculated to improve the tone of the nervous system, and with this end in view it should consist of meats and easily digestible fats as far as possible, starchy foods not possessing any great nutritive value for the neurotic. Besides the latter articles are the ones which increase flatulence, a troublesome symptom in most neurotic dyspepsias. The administration of alcoholics is also an important question, which cannot always be decided off-hand, owing to the complicated problems involved. Undoubtedly a strong alcoholic beverage acts as a reliable palliative, but just as certainly its ultimate action is prejudicial to the patient's interest. Neurotic subjects readily form drug habits, and thus may become alcohol habitues. This makes the responsibility of the physician in these cases very great. Puddings, pies and pastry are unnecessary articles of diet, and as their use may be prejudicial they should either be avoided entirely, or permitted with the greatest discretion.

Rest and exercise must be decided upon only after individualization of cases. Patients who are over weight will do better, as a rule, on out-of-door exercise, horseback-riding, bicycling, and tennis, being the most useful. These exercises serve not only as means for the improvement of nutrition, but also as mental diversion. As a rule, it is wise to prohibit athletic indulgence until some time after meals. Thin and anæmic patients probably do better on a course of rest. The extent to which this should be enforced, must also be individualized. In many cases, absolute rest in bed for one hour after the noonday meal is all that is necessary. Other cases require more rigidly enforced and more prolonged rest, and while in their comparatively active moments, should not indulge in violent exertions. Such an inactive life, however, in a person who is forced to eat freely, may lead to a true indigestion, which accident may be efficiently guarded against by daily general massage for one hour.

The free drinking of hot water is often a source of great relief, especially during the attacks of flatulence. Care must be taken lest the patient overindulge in this respect, as it is believed that the distention of the stomach in atonic dyspeptics may have an unfavorable result.

The moral management of these cases is as important as the physical. Many patients while at home or when pursuing their ordinary avocations, cannot partake of the simplest food without experiencing great discomfort, and yet while away from home, boarding at hotels—in other words, experiencing the beneficial influence of change of air and scene and mental rest—can eat freely of the most elaborate menu with apparent advantage. The good results from this course often last long after their return to their ordinary daily routine.

Some patients find a valuable remedy in lavage, especially when vomiting is a prominent symptom.

General measures for the improvement of the nervous tone, as cold sponge-baths, followed by brisk frictions every morning, are invaluable.

Some patients thrive on a cup of coffee prepared without boiling and taken without sugar or cream, immediately on rising in the morning.

The bowels must be carefully watched. Most nervous dyspeptics are constipated, and this of itself intensifies the digestive disturbances. When hygienic measures and the gastric remedies fail to relieve, the best medicine is *cascara*, which should be given in the form of dry extract, in tablets of from one to three grains three times daily.

Electricity is required in some cases. Galvanism or faradism should be employed according to indications. Intra-stomachic or epigastric applications may be used as required.

The use of digestive ferments must be individualized. Pepsin, pancreatin, or papoid may be used, but always with proper respect to physiological indications. When the digestion of starchy foods is at fault, malt extracts possessed of a diastatic action may be given. Of these Trommer's malt and maltine are the best. A very acceptable means of administration is the spreading of either of these preparations on bread.

In patients whose general nutrition is greatly depreciated and anæmia is marked, an absolute rest treatment may be required. The diet then must be carefully regulated, food administered in small quantities at short intervals until nutrition is improved, when a change to normal conditions may be gradually resumed. When the hysterical element is marked, it is important to remove the patient from friends and family.

Many remedies prove serviceable, but it must be remembered that medicinal treatment is subordinate to the general elements of treatment which have been detailed. *Strychnia* 2x is the remedy which is most

generally useful, given in one-grain tablets from three to six times daily. *Arsenite of copper* 2x often helps the painful sensations referred to the epigastrium, and also acts favorably upon the general nervous system. *Lycopodium* for the flatulent lithæmic patient; *nux vomica* for the irritable, hypochondriac dyspeptic; *ignatia* for the prostrated hysterical patient; and *sepia* for the nervous, lithæmic, feeble woman with uterine disease, are all familiar and useful prescriptions. Flatulent cases suggest *argentum nitricum, cinchona, lycopodium* and sometimes *subgallate of bismuth;* distressing sensations referred to the stomach, *cupr. ars., bismuth, hydrastis, hepar, sepia* and *sulphur;* prominence of associated mental symptoms, *chloride of gold, natrum muriaticum, nux moschata, pulsatilla;* if general debility is prominent, *aletris, helonias, phosphoric acid* and *arsenite of quinine,* etc. These and other medicines must be carefully studied for each individual case.

Numerous other remedies may be of value, but those just mentioned, along with the hygienic rules given, are sufficient for the great majority of cases. It must be remembered, however, that results cannot in any event be obtained in a short time, and that a plan of treatment once formulated should be persisted in until proven curative or valueless.

ACID DYSPEPSIA.

Roberts in his admirable lectures on digestion and diet refers to two varieties of dyspepsia common among so-called healthy persons. These he calls the "atonic" (corresponding to the nervous dyspepsia just described), and the other "acid or irritative dyspepsia." In this latter variety the proportion of hydrochloric acid in the gastric juice is increased. It corresponds to the hydrochlorhydria of other authors; also denominated by some "Reichmann's disease."

These cases are often attended by an undue sensitiveness of the epigastrium. Food is eaten freely and with relish in many instances. Various morbid sensations are experienced, and include fulness and tightness about the epigastrium, flatulence, acid eructations, nausea and sometimes actual vomiting. Pain sometimes becomes a prominent symptom and extends far beyond the gastric limits. It has been attributed to the action of the acid gastric juice on the delicate mucous membrane of the stomach. It some cases it is undoubtedly due to butyric acid, produced by fermentative changes. Mental depression is almost as characteristic. The pain is greatly exaggerated by the patient. Sometimes pains are paroxysmal.

The treatment recommended by Roberts, and which I have employed with pronounced success, is the induction of salivation by the chewing of gum. This introduces into the stomach a digestive fluid of alkaline reaction, and is a physiological remedy of great value. Other measures recommended in the preceding article are also of value.

Ewald, in his admirable work on Diseases of the Stomach, considers a number of minor gastric neuroses, which for the sake of completeness may now be reviewed. His original observations have been made the foundations for the work of clinicians the world over.

GASTROXYNSIS.

This is a condition allied to migraine, attacks of which succeed certain definite causes, as emotional disturbance and mental exertion.

ERUCTATIO.

This is also known as nervous belching. It occurs especially in hysterical subjects. The escaping gas is believed to be atmospheric air, which has been swallowed. It occurs therefore independently of fermentation changes in the food. It nearly always escapes upward, because the pylorus is spasmodically closed. Sometimes the air does not come from the stomach, but from the œsophagus.

PNEUMATOSIS

is a condition in which the stomach is distended with gas. The attendant symptoms are a sense of distention and marked nervous phenomena, some of which are reflex and others result from the upward pressure of the stomach against the diaphragm and the thoracic viscera. There are marked dyspnœa, throbbing of bloodvessels of the head, palpitation of the heart, anxiety, and even unconsciousness. Relief comes with escape of the gas. Relief may be brought about artificially by the introduction of the stomach tube. Permanent cure seems to be effected with difficulty.

NERVOUS VOMITING.

This symptom is comparatively common. It is present in quite a variety of organic affections of the central nervous system, and may be associated with organic diseases of the liver, kidneys and uterus. It is this form of vomiting which is observed in the course of migraine and seasickness.

Nervous vomiting occurs, as a rule, without any true nausea. Sometimes all food is rejected, in others the patient retains certain articles. General nutrition is remarkably good when the severity of this symptom is considered, probably because the patient always retains sufficient to satisfy the demands of the system. As a rule, the disease is not serious. Occasionally one meets with an instance in which emaciation and prostration are extreme, and most urgent measures are needed to preserve life. In such, rest, forced feeding, seclusion, lavage, massage, etc., may be successfully employed.

PERISTALTIC UNREST.

Also known as tormina ventriculi. It is characterized by exaggerated peristaltic movements of the stomach, made manifest by loud gurgling sounds and annoying subjective sensation or pain, aggravated after eating. It is best treated by general hygienic measures, *strychnia* 2x three times daily, and lavage.

PYROSIS.

Generally known as heartburn or waterbrash. This consists in the rising of sour masses from the stomach. In many instances it is symptomatic of objective gastric states, but may exist as a neurosis.

POLYPHAGIA.

Polyphagia or acoria is the want of sense of satisfaction following eating. It is believed to be due to anæsthesia of the stomach. It is often associated with bulimia. It is a manifestation of hysteria and neurasthenia. In the management of these cases it is important to limit the amount of food.

BULIMIA.

Bulimia is an increased hunger, and leads the patient to partake of enormous quantities of food. It may be symptomatic of a great variety of organic and functional diseases. It is generally regarded as a prominent feature of tapeworm. In this connection may be mentioned those remarkable instances of perverted appetite which have been recorded from time to time. In one case the patient, an imbecile child, had a perfect mania for swallowing pebbles and other indigestible substances, and on one occasion partook of no less than three-quarters of a pound of irregularly shaped stones, rusty nails, etc., without apparent detriment. The craving for slate pencils and chalk experienced by pregnant women affords another example. In cases of bulimia it may prove nearly impossible to appease hunger, the patient demanding more food at a time when the stomach is already unduly distended. The supposition that the symptom depends upon a too rapid evacuation of the stomach seems to rest upon a purely theoretical foundation.

ANOREXIA.

In this condition there is a great loss of appetite, or even a disgust for food. It is a symptom observed in the great majority of organic affections of the stomach. It may also occur as a pure neurosis, arising either as an idiopathic condition or as the result of gastric hyperæs-

thesia. Sometimes it is the primary condition, the resulting failure in nutrition producing the hyperæsthesia. Sometimes it follows purely purely emotional agencies, as grief and worry.

REGURGITATION.

Regurgitation consists in the raising of portions of fluids or solids by reason of relaxation of the cardiac orifice. Within certain limits it cannot be regarded as an abnormal condition, but when repeated day after day or at short intervals, it is pathological. When persistent it may lead to serious alterations in nutrition. When mild, it can often be prevented by an effort of the will. It is not attended by nausea.

MERYCISMUS.

Merycismus or rumination is a condition in which the food is regurgitated, chewed a second time, and then re-swallowed. The wildest theories in explanation of this phenomenon have been advanced. Autopsies have demonstrated, in a limited number of instances, dilatation of the stomach and œsophagus. In such cases the explanation offered by Hammond that the regurgitated food has never been in the stomach is not improbable. For the majority of cases the only reasonable explanation is that which ascribes them to a neurotic origin. This is sometimes hereditary. Imitation is responsible for some cases. The phenomenon seems to be especially liable to occur in neurasthenic, hysterical, or epileptic patients. No class of society or no age is exempt. The nutrition of the patient may be well preserved or depreciated.

Remarkable tales have been related to show that certain articles only are regurgitated and remasticated. They lack authenticity, however. Analyses of the stomach contents give no definite results; sometimes there was hyperacidity, and sometimes an absence of acidity. The symptom seems to be beyond the control of the will; indeed, efforts to repress it may be painful.

ATONY OF THE STOMACH.

Atony of the stomach is most frequently a concomitant of a variety of dyspeptic conditions. It may also occur as an idiopathic neurotic state. It has been divided into partial and complete; in the former instance, only a portion of the gastric walls being affected. Food remains too long in the stomach, and secondary changes are liable to ensue in consequence.

INCONTINENCE OF THE PYLORUS.

Incontinence of the pylorus may result from a variety of morbid conditions. Thus it may be present, as shown by Ebstein, in the case of

certain unyielding morbid growths, so situated as to maintain the pylorus in a permanently patulous condition. It may also appear as a pure neurosis. Its diagnosis is difficult. It may be assumed to exist when intestinal peristalsis and unrest appear shortly after the ingestion of food and these are shortly followed by imperfectly digested stools. The failure to distend the stomach by gaseous injections has been regarded as an important sign. Kussmaul attached diagnostic importance to the ability to withdraw bile and intestinal contents from the stomach by the tube while the patient was fasting.

SPASM OF THE CARDIA.

Spasm of the cardia occurs in neurotic subjects and in association with quite a variety of functional nervous diseases. It is manifested by a sense of constriction with tympanitic distention of the stomach, which is relieved by belching. In some cases there is difficulty in deglutition.

AFFECTIONS OF THE INTESTINES.

ACUTE CATARRHAL ENTERITIS.

Synonyms.—Enteritis; catarrhal enteritis; acute diarrhœa; ileocolitis; acute intestinal catarrh.

Definition.—An acute inflammation of the intestinal mucous membrane.

Varieties.—Clinically, quite a variety of types of acute intestinal catarrh are observed, the difference in symptomatic phenomena depending largely on the intensity and seat of the inflammation and the causes of the trouble. According to the severity of the disorder, cases are divided into mild and severe; according to the location of the inflammatory changes, into duodenitis, jejunitis, ileitis, colitis, etc.; and according to cause, into primary and secondary cases. The division into mild and severe cases is simply a practical clinical division. A classification based on anatomical grounds is not practicable, for the inflammation is rarely limited to one particular portion of the intestinal tract, and even when it is so localized the symptoms are not often sufficiently distinctive to make a differentiation certain. The etiological classification into primary and secondary cases must be recognized, for it is always a matter of great importance to decide whether the inflammation is the lesion *per se*, or is secondary to some other disorder, as typhoid fever, measles, etc.

Etiology.—The causes of acute intestinal catarrh are both predisposing and exciting. Those of the former class may be inherent to either the patient or his surroundings. Some persons are peculiarly liable to intestinal catarrh upon exposure to very slight causes. Some are only susceptible when the cause operates from a certain direction. Others exhibit also a remarkable predisposition to disturbances of other mucous membranes than the intestinal. Age exerts a most remarkable influence in the production of acute catarrhal enteritis, the greatest liability to it being observed at the extremes of life, viz., children under two years of age and people of advanced years. Predisposition seems to be increased by habit, *i. e.*, the occurrence of one attack renders the liability to succeeding ones greater. Much importance has been attached to seasonal influences, the majority of cases occurring during the hot months of the year. While hot weather, temperature *per se*, undoubtedly is an etiological factor, it must be remembered that the summer season

brings with it a number of other factors which of themselves serve to make attacks of intestinal catarrh unusually frequent.

Considering the exciting causes, we find indiscretions in diet ranking as the most frequent. They consist of the ingestion of food irritating to the intestinal mucous membrane. The food may be proper in quality, but is taken in such quantity that the normal digestive processes are unable to cope with it and it becomes a foreign body, or it may consist of such articles as are notorious for their liability to bring on intestinal disease, *e. g.*, unripe fruits, green corn, cucumbers, cherries, lobsters, crabs, etc. Impurities in drinking water constitute an important dietetic cause. The injurious water is usually one contaminated by decaying organic matter. Sometimes it is so manifestly bad that all who partake of it suffer. In other instances it seems to affect only those who are unaccustomed to its use. This fact undoubtedly explains many of the cases of acute intestinal catarrh occurring among travellers. Next to dietetic indiscretions, exposure to cold is the most frequent cause. This may operate through neglect on the part of the patient to wear sufficient clothing, or the disease may be developed by unexpected changes from hot to cold weather. The patient may have been sweating profusely when exposed, and thus internal congestions with intestinal catarrh result. Some cases arise from lying on damp ground. Not infrequently acute intestinal catarrh results from purely nervous causes, as instanced in examples of the disease succeeding violent emotions, whether fright, grief, joy, or any unusual excitement. Organic as well as inorganic poisons occasionally produce the disease. Prominent among those capable of this effect are arsenic, corrosive sublimate, certain purgatives, the caustic alkalies and the mineral acids. The importance of exposure to an atmosphere contaminated with sewer gas has been variously estimated by different clinicians. Undoubtedly sewer gas contains germs which may produce the disease under consideration. Epidemics of acute intestinal catarrh are occasionally observed, and result from the simultaneous exposure of a number of persons to one or more of the causes above enumerated.

As a secondary condition acute intestinal catarrh is found present in both local and constitutional disease. It is one of the prominent associations of disturbance in the portal circulation, as it is one of the most serious complications of the last stages of phthisis. It is found associated with many of the infectious diseases, notably typhoid fever, septicæmia, pyæmia and pneumonia, and is sometimes a troublesome factor in anæmia, Addison's disease and the chronic inflammations of the kidneys.

Pathology and Morbid Anatomy.—The anatomical changes in acute catarrhal enteritis are rarely marked, even in those instances in which the symptoms during life have been of a severe grade. They con-

sist of the ordinary phenomena of catarrhal inflammations in general, viz: swelling, redness and increased secretion. Sometimes even these may not be seen at the autopsy. In more marked cases the mucous membrane exhibits decided alterations in structure, being softened, easily broken down and sprinkled to a greater or less extent with minute hæmorrhagic extravasations. The lymph and solitary follicles and Peyer's patches may be swollen, and even small erosions may occur.

Symptomatology.—The symptoms of acute intestinal catarrh arise from three factors, the excessive mucus production, the increased peristalsis, and the decomposition of the intestinal contents. The onset of the disease may be either slow or sudden. In the former case evidences of indigestion, general ill-feeling, etc., are the phenomena which suggest an impending disturbance of health. In the latter the first indication of illness is found in abdominal pain and diarrhœa.

Of the symptoms diarrhœa is the most important. The first two or three stools may be natural in appearance, but are noteworthy because of their size and the short intervals at which they are repeated. Then their consistence rapidly diminishes until finally they are fluid in character and frequently repeated, all the way from five or six to twenty or more being discharged in the twenty-four hours. In quantity also they present the greatest variations, sometimes consisting of but a few ounces and again composed of an amount of material almost incredible to contemplate. The average is said to be about four fluid ounces. As much as forty pounds of excrement are said to have been discharged in twenty-four hours in one extreme case. The fluidity of the stools is due to the transudation of serum in their rapid passage through the intestinal tract. The stools may present quite a variety of colors, sometimes being brown, and others yellow, gray, white, black, or green. Mucus may be small or large in amount. Blood is a rare constituent, being found mainly in cases resulting from traumatism or burns of the surface of the body. When present in any quantity it is strongly suggestive of ulceration rather than of catarrhal inflammation.

Next to diarrhœa pain is the most important symptom. Occasionally it is absent. It often precedes the stools and is relieved immediately after the evacuation. Ordinarily the patient finds considerable relief from bending double and exerting pressure on the abdomen. Sometimes its location is suggestive of the portion of the intestinal canal involved. It is infrequently associated with tenesmus, the presence of which indicates that the colon is at least in part the seat of disease. Sometimes it is dependent upon intestinal distention by flatus, and is greatly relieved when the confined gas is expelled.

Many cases, indeed all those of a more marked character, are attended by considerable flatulence, which is manifested by tympanites and loud rumbling as the gases are passed onward through the intes-

tinal canal, the escape of which per anum generally gives the patient great relief. The flatulence is the result of decomposition changes in undigested food and the mucous secretion of the bowel. Sometimes it is more prominently marked in one portion of the intestines than another; *e. g.*, the colon, which structure may then display distention over its course.

General gastro-intestinal symptoms are often present. They consist of epigastric and abdominal discomfort, poor appetite, thirst, coated and dry tongue, nausea and even vomiting.

In many cases fever is present, assuming, as a rule, the remittent type. It is always inconsiderable, excepting in the presence of some complication, when it may attain a high point. Some cases are ushered in by slight rigors. The fever is always a more marked phenomenon in cases arising from exposure than in those due to indigestion.

If any changes are found in the urine they consist of deepening of the color of that fluid, which is usually found rich in urates. Tube casts are said to be present in some cases.

Very severe attacks are attended by alarming symptoms. In children, delirium may be present. When the drain on the system from the excessive discharges is great, the patient sometimes passes into a state of collapse, evidenced by the presence of all the clinical phenomena of that condition.

Diagnosis.—The diagnosis of acute intestinal catarrh involves the recognition of the portion of the bowels involved on the one hand, and the differentiation of the malady from other diseases which may simulate it. The former is not often, as has already been intimated, a possible task. Still there are symptoms which may sometimes enable us to approximate an opinion. Duodenitis is usually preceded by gastric catarrh, and jaundice is very apt to supervene. Pain and tenderness in the right hypochondrium are often present. In jejunitis and ileitis, which are rarely disassociated, diarrhœa is not a prominent symptom; indeed it may be entirely absent, owing to the absorption of the liquid portions of the stools in their passage through the lower portions of the intestinal tract, the same being true of duodenitis. The stools show evidence of bowel disturbance by containing undigested food, and unaltered bile and colicky pains cause considerable suffering. Colitis likewise rarely exists alone, being usually associated with some degree of ileitis. Diarrhœa is present, but pain is not severe, and assumes a steady rather than a colicky character. Tenesmus is a source of great suffering. Catarrhal inflammation of the rectum (proctitis) exhibits its most prominent feature in frequent desire for stool, with tenesmus and pain in the left iliac region. There are other local symptoms indicative of rectal disease, as tenderness, spasmodic contraction of the sphincter ani, and prolapsus recti.

The diseases which may be confounded with acute catarrhal enteritis are typhoid fever and enteralgia. A separation from the former cannot be readily made in the first days of the disease. Etiological considerations offer suggestions which, as a rule, lead to correct conclusions. Negative evidence, *i. e.*, the absence of the peculiar typhoid fever curve, rose-colored spots and the enlarged spleen, are of much value after the first week.

Prognosis.—The outlook of acute intestinal catarrh is nearly always favorable, the only exceptions occurring in the very young or the aged, and in persons whose previous habits have led to decided constitutional deterioration. The duration of the disease ranges from one or two days to as many weeks.

Treatment.—The patient with acute intestinal catarrh, even with an absence of febrile symptoms, should remain at rest in bed until the symptoms are controlled. During the first day or two the diet should be very light, consisting of a little milk with Vichy or lime water, whey, light broths, etc. It is better not to resume solid food until the loose passages have ceased. A premature resumption of solid food or of exercise may lead to protraction of the disease.

A few cases attended by fever yield promptly to *aconite, gelsemium, belladonna, ferrum phosphoricum* or other remedies directed mainly to the early hyperæmia, but it is seldom that the first two mentioned are useful after the very early stage. For the average case the *arsenite of copper* may be administered in the second decimal trituration with considerable confidence of a good result. It is most useful for cases attended with pain. If the attack has followed upon imprudent eating, *nux vomica* often proves sufficient; but for the typical attack, if the arsenite of copper has not relieved, it is necessary to turn to such medicines as *arsenic, colocynth., colchicum, ipecac., mercurius, iris, podophyllum* and *veratrum album. Arsenic* may be indicated in the early stage and be successfully administered at that time, but it is more frequently employed after a variety of medicines of a simpler character, at which period of the disease the more characteristic group of arsenic symptoms is likely to be observed. They consist of purging, abdominal colic, sometimes vomiting, burning pains in the rectum, a good deal of thirst for small quantities, and a general irritable, restless condition. If the attack is a severe one, there may be coolness of the surface. *Colocynth.* is an admirable remedy for these cases, the important indication being the colicky pains which are relieved by pressure or bending double. It possesses all other essential symptoms. *Ipecac.* is preferable when the stomach is involved, nausea and vomiting being prominent symptoms. The stools are grass-green or fermented, and there may be severe colicky pains below the umbilicus. The mercurial preparations, especially *mercurius dulcis*, are called for if the colon or rectum is involved, with tenesmus, and blood and mucus in the

stools. If the small intestine is more particularly involved, with profuse watery stools and not much pain, *podophyllum, croton tiglium, colchicum* and *cinchona* should be studied. Cases tending to protraction are sometimes helped by *phosphoric acid, gamboge* or *sulphur.*

With protraction of the disease it is not uncommon for the abdomen to be distended and for symptoms of a typhoid type to develop. Under these circumstances *arsenic, baptisia, phosphoric acid* or *phosphorus, rhus tox.* and *sulphur* are most likely to prove beneficial.

CHRONIC DIARRHŒA.

Nomenclature.—While the employment of the title of a symptom as a means of designating a special clinical condition is decidedly unscientific, the use of the term "chronic diarrhœa" for this purpose is attended with such convenience as to make it comparatively free from objection if it be borne in mind that it is symptomatic of a great variety of pathological lesions. The ordinary synonyms of chronic diarrhœa, viz., chronic enteritis and chronic intestinal catarrh, while pathologically correct in very many instances, are by no means universally so, for they constitute only two of the lesions of which chronic diarrhœa is a symptom.

Etiology.—Chonic diarrhœa may start as such, or it may be a continuance of a severe acute attack, the same causes tending to establish the chronicity in either case. These include deleterious agencies acting constantly on the intestinal structures on the one hand and constituting a source of constant irritation, and on the other of severe constitutional diseases as malaria, tuberculosis, cancer, passive congestion of the liver, chronic interstitial nephritis, living in foul air and bad general hygiene. A badly selected diet is the most frequently observed local cause. This is the cause when the trouble occurs in children brought up on artificial food. In adults the offending diet consists of articles difficult of digestion, or the partaking of ordinarily innocent food in excessive quantities. Excessive alcoholic indulgence undoubtedly is capable of giving rise to very many of the lesions which attend chronic diarrhœa.

Sometimes the disease develops upon hereditary influences and personal idiosyncrasy, just as a catarrhal inflammation of other mucous membranes is observed in other individuals. The chronic diarrhœa among soldiers in camps and prisoners closely confined is due to a combination of causes, namely, bad air, bad hygiene, exposure, fatigue and improper food.

As a symptom, the occurrence of chronic diarrhœa is especially worthy of note as occurring in the course of pulmonary tuberculosis and Bright's disease. In the former connection it is observed usually in the latter stages of the disease, and is dependent upon ulceration or lardaceous disease of the intestines; in the latter it is generally regarded as a conservative process, the intestines acting vicariously for the kidneys.

The chronic diarrhœa of gouty subjects also is often a conservative symptom, as evidenced by the greatly improved condition of the patient during its continuance.

Pathology and Morbid Anatomy.—A study of the pathology of chronic diarrhœa involves a consideration of nearly the entire domain of pathology. In the simplest cases the changes observed are essentially those of acute intestinal catarrh, followed by secondary changes due to the long continuance of the trouble. Hypertrophies, atrophies and ulcerations of the intestinal coats ensue. The walls of the intestines become greatly thickened or thinned, and contractions or dilatations of their lumen are prominent pathological features. According to the character of the lesions the intestinal mucous membrane is dark or light red, drab or slate color, these color changes being diffuse or occurring in streaks or mottlings. The bright red is suggestive of acute inflammation; the dark red, of extravasations; the brown and slate colors, of old extravasations and pigment deposits; the dark-purple and black, of approaching, if not already existing, destruction of tissue. The mucous membrane may be either softened or indurated. Changes in all the glandular structures of the intestines are common, and partake of the nature of either atrophy or hypertrophy. They sometimes undergo quite extensive retrograde changes and by the coalescence of several lesions form quite extensive ulcerations. In some cases the glandular orifices become occluded and cysts form; and again, the mucous membrane hypertrophies, assuming the form of polypi.

In many cases the intestinal ulcerations extend both in surface and depth, resulting finally in perforation of the bowel.

Tubercular ulcerations are almost invariably associated with pulmonary lesions. In very rare instances the intestinal trouble is the precursor of that in the lungs.

Symptomatology.—Frequently repeated stools of diminishing consistence is the prominent symptom. Its qualifying features, *i.e.*, the external appearances of the discharges and their attendant symptoms will, of course, vary according to the nature and severity of the case. In the beginning of the trouble the diarrhœa rarely exists as a constant condition. The patient often appears to be in a fair state of health, but very slight causes excite looseness of the bowels. In other cases diarrhœa and constipation alternate. The frequency of the evacuations varies greatly, generally not exceeding eight in the twenty-four hours. Sometimes there is but one stool daily, and that a very large one, occurring usually in the morning. Frequently the stools are provoked by definite causes, as exertion or the ingestion of food. The size of the stools generally bears a direct relation to the extent and severity of the lesions. In the majority of cases they range from two to four ounces. In consistence they may be watery or semi-solid; in color, brown, blackish, yellow, green, or white.

They not infrequently contain portions of undigested food, mucus, pus and blood. They may be odorless or highly offensive.

The presence of mucus affords positive evidence of the catarrhal condition of the bowels. It occurs in flakes mixed with the fæcal masses, or it is so large in quantity and so generally distributed throughout the stool as to give the latter a jellified appearance. Sometimes the stools consist almost exclusively of mucus.

Blood appears in the stools in streaks or in quantity. Its characteristics depend largely upon the portion of the canal from which it is derived. When from the rectum, it appears as coagula; when from the highest portions of the intestinal tract, like coffee-grounds or a dark tarry substance.

Pain is commonly present and like the other symptoms presents wide variations. Sometimes it develops at a definite period after eating, and gives unmistakable evidence of having resulted from intestinal indigestion; sometimes it occurs just before a stool; in other cases it seems to be dependent upon flatulent distention of the bowels, and is relieved by the expulsion of the same per anum. Sometimes paroxysmal pains are not prominent features of the case; but in their stead a diffuse abdominal soreness is experienced.

Only exceptionally does the stomach escape some changes, for with the diarrhœa we often observe loss of appetite, foul taste in the mouth and morbid appearances of the tongue. In the mild cases the tongue is coated or pale and flabby; in the severe, when the alterations in the intestinal mucous membrane are of a permanent character, it is smooth, shining or glazed.

The general constitutional state suffers severely from the constant drain. The skin becomes dry and harsh, general weakness and emaciation supervene, the patient exhibits mental depression, incapacity for mental labor, restless sleep, and changes in disposition. Fever is, as a rule, absent, although some forms may be attended by considerable rise. An evening temperature of 99.5° or 100° F. is not uncommon. The pulse is generally quickened and weak, changes generally due to the patient's prostrated state. The urine presents no characteristic alterations. It may be concentrated owing to the large quantity of liquid excreted by way of the bowels; sometimes it contains albumin and casts.

In the last stages of the disease atrophy of the mucous membrane is present, and is shown clinically, according to Nothnagel, by "the persistent passage of one soft, unformed stool daily."

Very mild cases of catarrhal enteritis exhibit few of the characteristic symptoms just described. The sole evidence of disease is found in the expulsion of mucus with naturally formed stools and abdominal distention and pain.

Diagnosis.—The recognition of chronic diarrhœa is, of course a simple matter; but the determination of the pathological lesion, whether a simple catarrhal inflammation, an ulceration, etc., or the recognition of the portion of the intestinal tract involved, is often difficult. In a general way, it may be stated that mucous discharges betoken catarrh, sanguineous and purulent, ulceration.

Duodenitis is manifested by gastric symptoms, jaundice, clay-colored stools and the presence of bile in the urine. Diarrhœa is not a prominent symptom. Fats are not readily digested.

With involvement of the balance of the small intestine, the jejunum and ileum, pain is localized about the umbilicus, tympanitic distention is prominent, and there is oppression after eating. The inability to digest sugars and starches is especially marked.

With disease of the large intestine the pain is along the line of the colon and more severe than when the small intestines are alone affected.

The secondary origin of a chronic diarrhœa is to be recognized only after a thorough physical examination, involving an inquiry into the condition of the lungs, heart, kidneys and nervous system, and a searching investigation into the presence or absence of syphilis, gout and other constitutional vices.

Prognosis.—Cases complicating organic diseases of the lungs, heart or kidneys are rarely curable. As a purely local disorder it is always intractable, the chances of cure diminishing with the length of time the condition has existed. Symptoms suggestive of an unfavorable result are emaciation, fever, frequent and large-sized stools, and œdema of the extremities.

Cases that are cured are not necessarily restored to perfect health. The healing of extensive ulcerations often means the formation of extensive cicatrices which contract and diminish the intestinal lumen, thus obstructing the fæcal movements.

Any of the diseases which produce chronic diarrhœa may become complications of it; thus it has given rise to pneumonia, pleurisy, bronchitis, kidney and hepatic disease.

Death results from exhaustion, cerebral thrombosis, intestinal perforation, or peritonitis.

Treatment.—The treatment of this affection is always difficult and often unsatisfactory, even when it is not associated with apparently incurable primary disease. Thorough and repeated search for a cause should be made, including the lungs for phthisis; the rectum for polypi, cancer, or scybalous masses; the abdomen for tumors; the liver for cirrhosis or other lesions; the urine for Bright's disease, and this fluid as well as an investigation into the history of the case, for the presence of a gouty diathesis, etc.

Of the various general items of treatment which are of prime

importance a proper degree of *rest* may be first mentioned. In the milder cases it is only necessary to order an avoidance of the least fatigue, quiet after taking of food, and a period of rest in recumbency during the middle of each day. But in troublesome cases much higher degrees of quiet are essential to recovery, even absolute confinement to bed in many cases. It is in the milder cases that this feature of treatment is most likely to be neglected.

The *diet* may have to be regulated in considerable measure by the cause, *e.g.*, in gouty cases nitrogenous food must often be prohibited. In general, vegetables and fruit should be excluded. Milk in all forms is permissible, and may often constitute the only article of food taken. In some cases it may become advisable to peptonize or pancreatize the food before giving it.

It is a favorite plan with me to first put the patient upon a milk diet, and after a thorough trial of this article to add others, one by one, never employing a new variety of food until convinced that the last one added agrees with the patient. In this manner stale bread, well-cooked cereal foods, meat, etc., are gradually added to the dietary. It must be understood that rigid adherence to instructions and persistence in carrying out the plan are essential to success. Many a chronic diarrhœa is continued as the result of improper conduct of the case due to a want of appreciation of the persistency of the disease and the necessity for the employment of dietetic and other measures long after the patient appears to have recovered.

The care of the *skin* exercises much influence upon chronic diarrhœa. Warm baths should be frequently employed, also cold morning sponging. If the patient is weak the latter should be given by an attendant. Frictions and massage of the extremities and of the superficial tissues of the body tend to lessen blood pressure in internal parts.

In many cases, especially if there is a well-marked catarrhal lesion or ulceration, it is of great importance to employ irrigation of the bowels. The irrigation should be employed daily or less frequently, as the patient improves. Gentleness and persistence in the introduction of the water is important. Plain boiled water answers well, but occasionally salt, borax, boracic acid, carbolic acid, etc., may be added with advantage. Such agents should never be added in sufficient quantity to cause irritation.

The number of remedies recommended is very large, and of necessity the range must be a broad one. Only a few can be referred to.

In aggravated cases *mercurius corrosivus* most frequently gives good results. The colon and rectum are involved, consequently there is tenesmus. Glandular ulceration furnishes pus and blood and there is usually much mucus. A one to five thousand solution prepared with distilled water should be given in five-drop doses every three to six

hours. The dose may often be gradually increased with advantage, for this is one of the remedies which often acts most favorably when carried almost to the production of its physiological action. One must be persevering with this or any other remedy, not making changes with every little fluctuation of symptoms. *Arsenicum* is preferable when there is an absence of tenesmus with the dysentery-like group of symptoms. The stools are frequent and variable as to character, often semi-digested, with aggravation after food, exercise, etc. There is general failure with some degree of the well-known general group of arsenic symptoms, viz., thirst, restlessness, prostration, emaciation, circulatory feebleness, and frequently a night aggravation. Arsenic is also a remedy which must sometimes be given in material doses, *e. g.*, Fowler's solution, one to three drop doses several times daily.

In the course of all obstinate cases *sulphur* should be given. Its influence over chronic catarrh and diathetic conditions, and the frequency with which the general symptoms of this class of cases correspond with those of sulphur, are the especial reasons for its administration. The symptoms which most frequently yield to its action are a painless diarrhœa aggravated in the early morning and usually driving the patient out of bed. The character of the stools is not of much importance. *Natrum sulph.* may be considered when sulphur fails.

Argentum nitricum is often valuable in neurotic subjects who are troubled much with eructations. The stools are variable in character, but there are considerable mucus and little or no tenesmus. A fresh preparation of the second decimal dilution in distilled water should be employed.

Aloes is indicated by yellow fæcal movements, often passed unintentionally when urinating or emitting flatus. There is apt to be a dull, frontal headache, a feeling of weight in the right hypochondrium or in the abdomen, with slight colicky pains.

Cinchona often follows arsenic well, and is suited to painless, thin, semi-digested stools, which are more frequent at night and attended by much flatulence. The value of this remedy for persons who have lost vital fluids is generally asserted.

Calcarea carbonica is useful in the chronic diarrhœas of some young subjects who tend to fatness and are troubled with local sweats, a big abdomen and an irritable stomach with sour vomiting.

I learned from Dr. Hering the use of *gamboge* for persistent loose movements in old people. The aggravation comes in the morning. The stools are large and passed with a rush. In other respects the patient may be pretty well.

Subacute aggravations of chronic diarrhœa are not infrequent and call for the same treatment already described for acute intestinal catarrh, acute entero-colitis, etc. Any of the remedies mentioned under those

headings may also prove beneficial in chronic diarrhœa, as very many of the indications have no relation to intensity or duration of symptoms.

In obstinate cases most unusual medicines sometimes help, which suggest careful study of all the symptoms.

CHOLERA MORBUS.

Synonyms.—Cholera nostras; sporadic cholera.

Definition.—An affection characterized clinically by violent vomiting, purging, and pain, and dependent pathologically upon a high grade of inflammation of the gastro-intestinal mucous membrane.

Etiology.—Cholera morbus occurs with the greatest frequency in hot weather and in tropical countries, and especially so when hot days are followed by cool nights. Its favorite subjects are young adults, men being more predisposed than are women. Nervous influences are undoubted as predisposing factors, for the disease seems prone to attack subjects possessed of a sensitive nervous system, and those who have been debilitated by anxiety and other emotions.

The attack itself is generally excited by an intoxication arising from the absorption of septic material produced by the decomposition of the gastro-intestinal contents, and follows the eating of unripe fruits, decaying meats and vegetables, the excessive use of ice-water, especially when the patient is overheated, and the breathing of foul air.

Pathology and Morbid Anatomy.—The morbid changes consist of a high degree of inflammation of the gastro-intestinal mucous membrane excited by the irritation of the contents of the same, usually the toxic products of imperfect digestion.

Symptomatology.—The onset of cholera morbus is nearly always sudden, occurring generally at night and awakening the patient from sleep. Sometimes it is preceded by some slight evidences of ill-health, as malaise and loss of appetite. The first symptom is generally a pain or sense of oppression in the epigastrium, followed very shortly by nausea and vomiting of a most violent character. Almost at the same time equally violent purging sets in. Both vomiting and purging are accompanied by severe pains, which persist even after the evacuations. The vomited matters consist at first of food only; later they are composed almost entirely of mucus and bile. The first one or two stools present a nearly natural appearance, their principal departure from the normal being their lessened consistence. But as stool follows stool, they loose their fæcal character, and finally become watery and odorless, being then composed of mucus, blood-serum, epithelial cells and pus. The pains are always intense, their point of maximum intensity being about the umbilicus. They are burning, tearing, or cramp-like in character. Painful contractions in the form of cramps of various muscles, but especially those of the calves and the abdomen, are very common. Flatulent

distention of the abdomen is present in the early stages of the disease, giving place later to retraction of the abdominal walls. The urine is high-colored, lessened in quantity, and occasionally contains albumin and tube-casts. Severe cases sometimes end fatally, their terminal stages being characterized by collapse and stupor.

Diagnosis.—Cholera morbus may be mistaken for epidemic cholera and irritant poisoning. As regards its differentiation from the first mentioned, there is no difficulty in the absence of an epidemic of Asiatic cholera. During epidemics of the latter, cholera morbus is very prone to occur. Under such circumstances the only crucial differential point is to be found in the microscopic examination of the stools.

In irritant poisoning the gastric symptoms precede the intestinal by a much greater period than in cholera morbus.

Prognosis.—The prognosis of cholera morbus is nearly always favorable. The fatal cases are limited to persons debilitated by previous disease or to subjects at the extremes of life. The disease rarely lasts longer than two days, although convalescence is characterized by considerable exhaustion. Sometimes cholera morbus is followed by an obstinate gastro-intestinal catarrh.

Treatment.—*Arsenite of copper* is the best remedy with which to begin treatment in choleraic disease. It will usually prove the only one needed. The second decimal trituration, repeated every one half to two hours as required, proves the most satisfactory dosage.

In the milder cases with frequent movements and vomiting but little pain, and a white tongue, *antimonium crud.* is successful; or *cinchona*, if there are painless movements of undigested matter and distention of the abdomen with flatulence; but these painless cases are unusual. If the painful attack is not controlled by arsenite of copper resort must be had to *arsenic*, *cuprum* or *veratrum album* as directed in the article on epidemic cholera (Vol. I, p. 206).

In addition to these remedies *dioscorea* is recommended for vomiting and purging, the stools being watery, with cramps in the extremities as well as in the stomach and bowels. *Euphorbium* I have found useful when, with vomiting and purging of large amounts of ricewater-like substance, there was complaint of a deathly sinking at the pit of the stomach and faintness with cold sweat. *Iris vers.* The presence of bile in the vomited matters and stools is the guide to this remedy.

Colchicum is admirable when there is little pain but rapid prostration. The patient seems to be drained dry by the large watery stools, has a dry skin, sunken features and a husky voice, it is particularly suited to the cases developed when days are hot and nights cool.

PSEUDO-MEMBRANOUS ENTERITIS.

Nomenclature.—The nomenclature of pseudo-membranous enteritis is in rather a confused state owing to the variety of intestinal affections which different authorities have included under this title. Ordinarily, when speaking of membranous enteritis, we refer to a disease of the intestinal mucous membrane, occurring for the most part in neurasthenic or hysterical women, not accompanied by fever, and characterized by the discharge of a membranous-like substance with the stools. This affection has also received the designations, diarrhœa tubularis, mucous disease, fibrinous diarrhœa, tubular exudation casts of the intestines, and diarrhœa pituitosa.

Etiology.—Pseudo-membranous enteritis is a disease of adult life, occurring almost never during childhood, and most frequently observed in women past forty years of age. Its subjects are nearly always of a marked neurotic temperament, exhibiting numerous manifestations of hysteria and hypochondriasis. The exciting causes of the disease have not been determined. It would seem, however, that it arises from a perverted nutrition, the *modus operandi* of which has not been discovered. Some writers have pleaded for an infectious origin, but have not presented data sufficient even to make out a *prima facie* case. Very many of the cases are associated with ovarian disease and dysmenorrhœa. This fact is well worthy of attention, but it must not lead to too radical conclusions.

Pathology and Morbid Anatomy.—Owing to the non-fatal character of this disease, opportunities for post-mortem examination are rare and the morbid changes are but little known. Our ideas on the subject must therefore be based to a large extent on observations made during life. The lesions are limited, in the majority of cases, to the colon, although Powell describes cases tending to prove that the entire intestinal tube as high as the duodenum may participate. The lesions probably consist of a low grade of follicular inflammation. Wales's endoscopic examinations in the living subject revealed "the intestinal mucous membrane of a red verging into scarlet color, thickened and denuded of epithelium in patches of varying extent." Examination of the membranous discharges shows them to consist of mucin and not of fibrin. They may be discharged in quite a variety of forms. Thus they appear as loose, transparent jelly-like masses, shreddy, ribbon-like forms, tubular pieces which are exact moulds of the portion of the intestine in which they were formed, and small casts or flakes. They range in thickness from a mere film to a quarter of an inch. When thoroughly cleansed by washing they are transparent; when discharged, their coloration depends largely upon the materials with which they have come in contact.

The theories accounting for the origin of the disease are as various as they are unsatisfactory. Some writers declare the disease to be either dysenteric or diphtheritic; others ascribe it to a nervous origin; and still others contend that it is inflammatory.

Symptomatology.—The clinical course of pseudo-membranous enteritis is characterized by paroxysms of abdominal pain, tenesmus, digestive and nervous disturbances, the discharge of pseudo-membranous formations, and free intervals during which the patient exhibits many phenomena of hysteria and neurasthenia. The onset of the disease is nearly always chronic. In the beginning the patient complains of digestive disturbances, nausea and vomiting, alternate constipation and diarrhœa, abdominal discomfort especially along the line of the colon, and a sensation of heat in the bowels. With long continuance of the disease, marked disturbance of general nutrition occurs. The patient emaciates, and the complexion becomes of a muddy or waxy hue. Usually, the membranes are discharged only during a paroxysm, which is generally of from two or three days to a week in duration. Following the attack, the patient becomes greatly exhausted. Other cases are observed, and in my experience these represent by far the larger number, in which the membranes are discharged at any time, irrespective of the existence of the special symptoms belonging to the paroxysms. The pain in this disease varies greatly in intensity; in some cases it is barely perceptible; in others, it is agonizing. The nervous phenomena likewise present great variations; indeed, they may simulate any hysterical type.

Diagnosis.—The diagnosis of membranous enteritis is based on the chronic course of the disease and the presence of the pseudo-membrane in the stools.

Prognosis.—Cases of pseudo-membranous enteritis rarely end fatally. The disease, however, is very resistant to treatment, a cure being attained only after most careful attention to details carried on over a great length of time.

Treatment.—The most successful results have followed upon measures addressed to the general and not the local symptoms, but this is not to be considered as sanctioning neglect of the latter. The first essential in the management of these cases is the adoption of such general measures as will tend to improvement of general nutrition and the state of the digestion. When the nervous phenomena are very pronounced, it may prove essential to put the patient under a thorough rest-treatment (see article on Hysteria, Vol. I). In other cases, it is only necessary to exact a certain amount of rest daily, while the food administered is sufficient in quantity to maintain good nutrition, and sufficiently proper as to quality to be readily digested. Pain may be greatly alleviated by hot applications. The bowels should be thoroughly emptied during the attacks by means of large enemas. But little satisfactory

information can be given, respecting medicines, as the disease is not a common one, and but few cases have been reported in our periodicals. Snader cured one case with *rhus tox.*, prescribed, however, on purely symptomatic grounds. *Kali bichromicum* is a remedy which should prove of considerable value on pathological grounds. *Argentum nitricum* has a discharge of reddish or green shreddy substances from the bowels, with considerable burning pain in the abdomen. It is especially indicated by the associated hypochondriacal and hysterical symptoms. *Nux vomica* is another remedy adapted to the nervous manifestation of membranous enteritis. It is admirably indicated in some cases. The *mercurial preparations* are of use in this disease, the indications being the same as those ordinarily given for dysentery. *Iodine* gave me a good result in one case prescribed upon the symptom, emaciation with good appetite. The patient was thin, dark, and had a phthisical tendency. In another, *bromine*, in doses of five drops of the water from over the bromine, repeated four times daily, was of great service. There was swelling of the cervical glands. The subject was a fat, hysterical woman. *Hepar sulphur* and *hydriodic acid* should be considered.

DIARRHŒAL DISEASES OF CHILDREN.

The practice of designating all diarrhœas occurring in infants and children under some one title, varying according to the individual preferences of the medical attendant, is altogether too prevalent and demands decided condemnation. Such a procedure is just as irrational as if it were practised in the study of similar diseases occurring among adults, which method few or none would countenance The most desirable classification is that which will enable the practitioner to treat his cases most successfully, and this we believe to be the one adopted by Vaughan, and based largely upon etiological considerations. A pathological classification is useless in practice, also the lesions in fatal cases are generally found to be largely dependent upon the duration of the illness. The diarrhœal diseases of children will be considered under the following titles: (1) acute intestinal indigestion or simple diarrhœa; (2) chronic entero-colitis or chronic intestinal indigestion; (3) acute milk-infection or cholera infantum; and (4) subacute milk-infection or entero-colitis.

ACUTE INTESTINAL INDIGESTION OR SIMPLE DIARRHŒA.

Synonyms.—Simple or irritative diarrhœa.

Definition.—A form of diarrhœa occurring in infants and children dependent upon the inability of the gastro-enteric system to digest the food administered.

Etiology.—The first element in the etiology of this affection is one of predisposition. Young infants are especially liable to it, and for this

reason, in them, the work thrown on the small intestines is comparatively heavy, by reason of the relatively small secretion of saliva and the feebleness of the digestive functions of the stomach and pancreas. The active digestive process is then carried on in the intestines. In case of any disturbance the undigested food acts as a foreign body, *i. e.*, becomes an irritant, and diarrhœa results. Predisposing factors peculiar to individual patients also exist, and are exemplified in the enfeebled digestive powers of tuberculous, rachitic and syphilitic children.

The exciting cause is the administration of food improper in quality or excessive in quantity, the latter being the more commonly observed evil. In sucklings, normal methods of feeding are closely followed as a rule, so that the majority of cases are observed in bottle-fed subjects. These causes are especially prolific of harm in hot weather. In some cases improper feeding alone is not sufficient to bring on the trouble, some other extraneous cause, as exposure to wet or cold, inhalation of a foul atmosphere, improper clothing, filth, and lack of sunshine, seeming to be needed to disturb the balance and favor intestinal disorder.

Symptomatology.—The characteristic symptoms of acute dyspeptic diarrhœa are frequent loose stools, accompanied or not by vomiting, pain and flatulence. The diarrhœa varies greatly according to the severity of the case. In the mildest form it acts as a conservative process, ceasing entirely as soon as the digestive tract has been emptied of the irritating matters. As a rule the number of stools ranges from four to a dozen in the twenty-four hours. The first stool shows but little departure from the characteristics observed in health. Succeeding ones become more and more watery, and are found to contain milk curds. Sometimes they are greenish or variegated in color, and may be described by the nurse as looking like chopped spinach or chopped eggs. Sometimes they contain small quantities of mucus and blood. Vomiting, when present, is not a prominent feature. Like the diarrhœa it is generally a conservative symptom, relieving the stomach of irritating substances or excess of food administered. Some pain is nearly always present. It is colicky in character, and noticed especially before stool. It causes the patient to become restless, cry or draw up the legs. If very severe, the pain brings about the usual general evidences of suffering, viz., pale and anxious countenance, emaciation, and general relaxation. Flatulence is commonly present in the painful cases. Fever when present is not of high degree. Exceptionally it may reach 104° or 105° F., and maintain that point for a short time, but ordinarily the rise of temperature is unimportant. The pulse is not much disturbed, except during the paroxysms of pain, when it becomes quickened. Unless the attack is unusually severe or long-lasting, the state of general nutrition of the child is unaffected, little or no loss of weight being appreciable.

Diagnosis.—Acute dyspeptic diarrhœa is to be differentiated only from entero-colitis and cholera infantum. In the former the stools consist largely of mucus; and in the latter of serum. Cholera infantum, moreover, is accompanied by violent vomiting and pain, high fever, cool skin, and collapse. A diarrhœa presenting no features to distinguish it from the condition under consideration sometimes marks the onset of acute febrile disorders. Its nature can only be recognized by the subsequent course of the case.

Prognosis.—Acute dyspeptic diarrhœa offers a favorable prognosis, if proper methods of treatment are instituted. Cases occurring in rachitic, tuberculous, or syphilitic infants, as might be expected, are more serious than are others. The child with this trouble is always liable to the supervention of more serious diarrhœal affections.

Treatment.—The first essential in the treatment of acute dyspeptic diarrhœa is rest to the alimentary canal. With this end in view all food should be withdrawn for a period ranging from twelve to twenty-four hours. Water may be administered freely to allay thirst. Sometimes it is wise to give albumin-water or barley-water, but milk should be dispensed with for the time. A most careful search should be made for the dietetic irregularity which is probably responsible for the illness. Should the child be breast-fed, the mother's diet should be looked into, for her indiscretions can readily affect the quality of the milk. Again the quantity of her milk may have been impaired by emotional influences, the recurrence of menstruation, the advent of another pregnancy, or by an acute illness. In the case of the hand-fed infant too large a quantity has probably been administered, the food has been improperly prepared, or the milk used has undergone fermentative changes.

A few comments upon the artificial feeding of infants seem necessary. It will be generally admitted that the food which is nearest in composition to that furnished by the mother's breast will prove the best for infants. This indication has been met by the selection of a mixture of cream, milk, milk-sugar and water. The proportions of these different ingredients as well as the total quantity administered in the twenty-four hours will vary according to the age of the little patient. During the first week of life it is well to use whey in addition to the above.

The proportions of food found to give the best results at different periods of life are the following:

During the first week: Cream, two ounces; whey, two drachms; water, three drachms; milk-sugar, twenty grains. Feeding at two hour intervals, excepting at night. Total quantity for the twenty-four hours, twelve ounces.

From the second to the sixth week: Two drachms of cream, one and one-half ounces of milk, one ounce of water and twenty grains of sugar

of milk. Intervals between feeding, two hours, excepting at night. Total quantity for the twenty-four hours, seventeen ounces.

From the sixth to the eighth week: Half a fluid ounce of cream, ten fluid drachms of milk, ten fluid ounces of water, half a drachm of milk-sugar. Intervals of feeding, every two hours, excepting at night. Total quantity for the twenty-four hours, thirty fluid ounces.

From the ninth week to the sixth month: Cream, one-half fluid ounce; milk, two and a half fluid ounces; water, one fluid ounce; milk-sugar, one drachm. Intervals between feedings, two hours and a quarter. Total quantity for the twenty-four hours, thirty-two fluid ounces.

During the sixth and seventh month: Cream, half a fluid ounce; milk, four and a half fluid ounces; milk-sugar, half a drachm. Intervals between feedings, three hours. Total quantity for the twenty-four hours, thirty-six fluid ounces.

From this time up to the end of the first year, the proportion of milk may be slightly increased. Grated flour-ball may be added. This last-mentioned article is prepared as follows: One pound of good flour is tied firmly in a bag and boiled for ten hours. Then the bag is removed and the ball set aside to cool. In this condition it is covered with a thin doughy layer, which is pared off. The remainder is the portion for use. This is reduced to a powder by grating and one teaspoonful of the resulting powder made into a pap and administered once or twice daily. After the first year other articles of diet may be given, these being selected according to the experience of the physician. To give details concerning these is not permissible because of lack of space.

The directions above given must not be regarded as hard and fast directions, but subject to modifications. Some children at four months require the feeding of a child half that age. Then again, if the little patient is thriving on his milk diet, it will prove unwise as a rule to make any change simply to conform to given custom or rule.

Sometimes when the cream, which is the basis of the above diet, disagrees, barley water may be used instead of plain water, as it will act mechanically to break the coagulum formed in the stomach into small particles. In other cases good results will be obtained from the use of Fairchild's peptogenic milk-powder. In still other cases other infant foods are required.

Owing to bacterial contamination of milk it is sometimes advisable and even necessary to sterilize that article before using it. This may be done in apparatus sold in the shops for this purpose. Such milk, though giving better results than impure milk, is not wholly advisable, for it has been found that milk during the process of sterilization undergoes certain changes which render it less digestible.

As a substitute for cow's milk condensed milk is recommended by many physicians. There can be no question that infants thrive on it for a time and gain in flesh rapidly. But such little ones are not really

strong; their power of resisting disease being comparatively poor. Condensed milk cannot therefore be regarded as an ideal food for infants.

It is a great mistake not to give infants water. Even the youngest of them should be given a small quantity of pure water several times daily.

Of equal importance with the preparation of the food is the method of administration. The bottle used should be one free from angles and so shaped as to be readily and thoroughly cleansed. The nipple should be of soft pure rubber, and capable of being inverted for thorough cleansing, which should be done by scrubbing and not by rinsing. The bottle should be held by the nurse's hand, and the rapidity of taking carefully regulated so that from ten to fifteen minutes is consumed at a meal. The food given should be freshly prepared for each feeding.

Returning after this digression to the treatment of acute dyspeptic diarrhœa, we find other hygienic details than feeding important. Fresh air is a *sine qua non*. The child must be taken out daily and given fresh air and sunlight. Careful and thorough bathing must be practised daily. In hot weather it is well to sponge lightly several times a day. The clothing must be regulated according to the weather.

Medicines are of great value. The following suggestions are offered: *Aconite* is the best remedy for the initial symptoms, in cases caused by exposure to cold, as well as in others in which high temperature is a prominent feature. *Belladonna* is likewise adapted to febrile cases, but the element of pain is more marked. The abdomen is tender on pressure, the knees are drawn up and the child is drowsy, perhaps flushed. *Ipecacuanha* is suited to cases associated with nausea or frequent vomiting and colic. In these cases the stools are decidedly green, and often fermented in appearance. A very good remedy when symptoms do not suggest any special medicine is *cuprum arsenicosum*, which should be given in from two to five-grain doses of the third decimal trituration every two to six hours according to the demands of the case. This medicine finds its special indications in vomiting, colicky pain and frequent stools. *Chamomilla* has the colicky element well marked; the child is fretful and may have a flushed cheek. It is especially valuable in cases attended by much flatulence. *Podophyllum* gives admirable results when the stools are thin, copious, painless and attended by prolapsus ani. *Bismuth subgallate*, in doses of three grains with each feeding, helps many cases not yielding to any of the above, also one or two grains of *papoid* in each bottle of food often gives excellent results. Occasional hot applications to the abdomen are soothing. They may consist of baked flannel, or the same moistened with hot whiskey.

As a sharp line of demarcation cannot be drawn between the various forms of diarrhœa in children, it may be necessary to adopt in the treatment of simple diarrhœa remedies and general measures suggested for other forms (see page 627).

CHRONIC ENTERO-COLITIS.

Synonyms.—Chronic diarrhœa of infants; chronic intestinal indigestion; chronic intestinal catarrh.

Etiology.—The causes of this affection are essentially the same in kind as those of acute intestinal indigestion; through neglect, however, they are made to operate over a greater length of time, thus intensifying and perpetuating the resulting disturbances. In other cases, notwithstanding the correction of all bad habits, the diarrhœa continues because of the possession by the child of some dyscrasia, such as tuberculosis, syphilis or rachitis. Sometimes too, instead of being the continuation of a badly treated acute attack, it arises from the frequent repetition of acute intestinal indigestion. Heat, bad air, and filthy surroundings all aid in the production of chronic entero-colitis as of other diarrhœal diseases of children.

Morbid Anatomy.—The morbid changes found consist of a hyperplasia of the different lymphatic follicles, but especially of the solitary glands of the colon. In the very severe cases these are found to have undergone ulcerative changes.

Symptomatology.—Excepting in cases immediately succeeding the acute disorder, the disease is of gradual onset. The stools become increased in frequency or depart but slightly from the normal in their appearances. The child at the same time gives some evidences of not feeling as well as usual, being restless and fretful. Preceding the slight diarrhœa there may be found in the stools small particles of undigested food. Gradually the stools become more and more watery and take on a very offensive odor. The presence of undigested curd becomes more and more prominent. The fæcal matter is found mixed with mucus and even with small quantities of blood, these newly added substances increasing in quantity with the advancement of the disease. Sometimes the stools are green; in other cases gray and putty-like, which is mainly due to the amount of fat they contain. Flatulence with distention and colicky pains are commonly present and add to the child's discomfort. Tenesmus is a common symptom. It is seldom that the stools are not offensive.

The stomach does not necessarily suffer. The appetite is often unimpaired. Indeed it is sometimes remarkable to note the quantity of food which the patient will take with avidity. It even appears that the excessive nourishment taken only adds to the trouble, the diarrhœa increasing, and with it, the emaciation.

While as a rule the general state of nutrition fails rapidly, such is not necessarily the case, the patient occasionally remaining for some time plump and healthy-looking to the casual observer. Usually, however, there is wasting; the features are sunken; the general manner listless;

or there is constant moaning or other evidence of distress. Mouth complications, such as thrush and aphthous stomatitis, may set in. Fever is usually absent, and the pulse is weak and feeble. The tongue is dry and glazed; sometimes coated white or yellow.

The irritating character of the discharges often leads to inflammation of all portions of the skin with which they may come into contact. Prolapsus ani may occur. The exhaustion increases; the limbs become œdematous and cold.

With favorable progress there is a gradual reduction in all of the symptoms, but in general progress is not even, one or more periods of aggravation occurring in the course of convalescence.

Diagnosis.—The recognition of the presence of a chronic diarrhœa is a simple matter; but this does not constitute the diagnosis of chronic entero-colitis, or of the causes which have made the disease a chronic one. For this end it is necessary to go over the case carefully, investigating every function and determining wherein any organ is at fault or the general care of the child deficient. Sometimes the trouble is secondary to some other disorder. The presence of high temperature early in the course of the case is strongly suggestive of intestinal ulceration at that time; while preceding anæmia and emaciation as strongly suggest tubercular disease. As a further means of recognizing a tubercular diarrhœa it may be found that the general condition of the child does not keep pace with the intensity of the bowel symptoms; that the spleen is enlarged, and that lymphatic enlargements are also often present. The fever may present an irregular curve.

Prognosis.—Chronic entero-colitis is a serious disease, increasingly so with the tender age of the patient, the degree of atmospheric heat, and the imperfection of the nursing. In the absence of diathetic influences proper treatment should bring about a cure in nearly all cases, but only with careful attention to details. The great risk of infection by contaminated milk is one of the chief dangers. The disease lasts all the way from two months to a year.

Treatment.—This will be considered in conjunction with the treatment of cholera infantum and acute entero-colitis.

CHOLERA INFANTUM.

Synonyms.—Acute milk-infection; choleriform diarrhœa.

Definition.—A disease appearing in milk-fed infants, characterized by all the classic symptoms of epidemic or sporadic cholera, dependent pathologically upon a high degree of gastro-intestinal irritation, and caused by the introduction of an intensely irritating organic poison in infected milk.

Etiology.—Cholera infantum is fortunately a comparatively rare form of intestinal disturbance, for it is a very dangerous malady. As

the definition above given indicates, it is an acute poisoning arising from bacterial contamination of milk. It is largely confined to bottle-fed infants, though nurslings are sometimes attacked owing to the introduction of the necessary germs into its alimentary canal in some unknown manner. This view of the nature of the disease is important to bear in mind, as it has an essential bearing on the treatment of the affection.

Weather is a very important etiological factor, the occurrence of the disease being limited to the hot seasons.

Predisposing causes are found in the existence of an enfeebled digestion, acute dyspeptic diarrhœa, bad hygienic conditions, and faulty digestion.

Pathology and Morbid Anatomy.—Autopsies do not reveal the presence of any characteristic lesions. This fact gives color to the view that cholera infantum results from the introduction into the system of a highly irritant poison. Recent investigations by the ablest bacteriologists find this poison to arise, as already stated, from infected milk. Commenting on this subject Vaughan refers to the presence in the intestines, in health, of the bacterium lactis ærogenes and the bacterium coli commune. He then goes on to say: "The contents of the stomach and intestines in the so-called summer diarrhœas of infancy swarm with bacteria of many species, and some of these produce most powerful poisons. These bacteria multiply outside of the body and are disseminated widely and abundantly only when the atmospheric temperature reaches 60° F. or higher. This is the reason for the restriction of these diarrhœas to the hot months of summer. The most suitable culture medium for the growth of these bacteria is milk, and this is the food with which they most commonly find their way into the intestines of the child. A knowledge of these facts has led to the employment of the most efficient prophylactic measures for these diarrhœas. These measures may be grouped into (*a*) those which prevent the contamination of milk, and (*b*) those which destroy any germs with which the milk has already been contaminated. Since these diarrhœas are limited to children artificially fed in whole or in part, our prophylactic measures are devoted exclusively to cow's milk." It may be safely stated without argument that cholera infantum results from the products formed by these bacteria.

Symptomatology.—The onset of cholera infantum is sudden, and is characterized by severe vomiting and purging, so severe indeed as to produce most serious constitutional effects within an incredibly short space of time.

The vomited matters at first consist solely of the food, but later of mucus and bile. The stools in the beginning are fæcal, but with progress of the disease they become more and more watery and finally consist almost entirely of serum. At first they are acid in reaction and

fæcal in odor; but when purely serous, they are simply musty. Emaciation is rapid. The face becomes pale and features sunken. The thermometer in the rectum shows a high grade of fever, 103° to 105° F., or higher, notwithstanding which the surface of the body may give the impression of being cool. The child is highly nervous, restless, and moaning more or less constantly. Thirst is intense. The pulse is rapid and weak. As the case pursues its fatal course the child lapses into a stupor with half-open eyes, depressed fontanelles, and irregular pulse and respirations, in which condition it dies. In favorable cases, the vomiting and purging gradually cease, and the general condition of the patient improves.

Diagnosis.—While cholera infantum presents a close symptomatic resemblance to cholera Asiatica only, it is more frequently confounded with the ordinary summer diarrhœas of infancy. From them it is readily distinguished by its rapid onset, the high temperature, severe vomiting, and the serous character of the stools. In seasons when cholera Asiatica is epidemic a diagnosis may be a very difficult matter; indeed, it may only be possible by means of a bacteriological examination of the stools.

Prognosis.—The prognosis of cholera infantum when not promptly and properly treated is very grave; especially so in very young infants and in hot weather. Unfavorable symptoms are very high temperature, intense prostration, and the supervention of marked nervous phenomena. In some cases tending to a fatal issue the vomiting and purging cease, thus giving the parents a false sense of security as to the outcome. In truth this is accompanied by increased prostration and is an unfavorable sign. When with the amelioration of vomiting and purging, other symptoms improve, a favorable result is to be looked for. In all cases recovery is slow and is often interrupted by slight relapses after any indiscretion in diet.

The treatment of cholera infantum is more conveniently considered in association with that of acute entero-colitis, with which it is closely connected.

ACUTE ENTERO-COLITIS.

Synonyms.—Summer diarrhœa; gastro-intestinal catarrh; subacute milk infection.

Etiology.—Acute entero-colitis is a very common disease among infants and the result mainly of hot weather, infection by milk, and the causes already enumerated as producing acute intestinal indigestion. Why milk contamination should in one case produce cholera infantum and in another entero-colitis is not known. The trend of opinion favors the view that the poisons in the two cases are different, and that the character of the resulting ailment depends upon their relative virulence.

The dosage of the poison and the power of resistance of the child must be important factors.

Pathology and Morbid Anatomy.—The first changes observed are those of catarrhal inflammation of the ileum and colon. Following this the epithelium becomes thickened, softened, and the glandular structures enlarged. At the end of the first week both Peyer's patches and solitary glands, but especially the latter, undergo ulceration. The resulting sloughing is rarely deep.

Symptomatology.—The majority of cases are of gradual onset. The initial symptoms are hardly distinguishable from those of acute dyspeptic diarrhœa, consisting as they do of increased frequency of stools which contain lumps of casein, and are otherwise changed in appearance and consistence. They may or may not be odorless. If the latter, they never have the putridity peculiar to the chronic form of the disorder. The condition of the child grows worse; mucus in large quantities appears in the stools, and fever is observed. The temperature, however, never attains the high point reached in cholera infantum. In mild cases it may be present only in portions of the twenty-four hours. With further progress the stools become still more frequent, and, in addition to mucus and fæcal matter, contain streaks of blood, and are associated with abdominal pain and flatulence.

Vomiting may be present, but, as one can readily judge from the site of the lesions, it is not likely to be a prominent feature of the disease. In protracted cases, those in which gastro-intestinal fermentation is considerable, it may become a source of much concern.

Flatulence may or may not cause abdominal distention. The abdominal pain is either colicky or it may be manifested as slight soreness along the line of the colon.

The stools are generally irritating in character, as exhibited by the erythema of the buttocks which they produce in so many cases. There can be no doubt that ofttimes the severe ileo-colic irritation is a secondary condition arising from the local action of the intestinal contents.

The general nutrition of the child suffers greatly, and it emaciates rapidly. Boils may appear in different parts of the body. Enlargement of lymphatic glands is sometimes observed. Various forms of ulceration of the mouth add to the sufferings and still further complicate the problem of feeding the patient. Pulmonary and renal complications occur in some cases.

Diagnosis.—From acute dyspeptic diarrhœa, entero-colitis is to be differentiated by the duration of the disease, the large quantity of mucus appearing in the stools, and the fever; from cholera infantum, by its comparatively slow onset, absence of any great degree of vomiting, or of collapsic symptoms, and the fæcal and mucoid constituents of its stools.

Prognosis.—Acute entero-colitis is a serious disorder, although the prospects of recovery are most excellent under proper treatment. The disease ranges in duration from three or four days to as many weeks. Some cases pass through the acute stage successfully and then become chronic. In those ending favorably great care is required lest some indiscretion gives rise to a relapse. Danger in any given case is in proportion to the frequency of the stools, the quantity of mucus and blood they contain, the heat of the weather, the age of the patient, and the degree of carelessness in carrying out details of treatment.

TREATMENT OF ENTERO-COLITIS AND CHOLERA INFANTUM.

The preventive treatment of these affections consists in attention to all details of infant hygiene and the use of milk free from bacterial contamination. Inasmuch as one can never be certain during the hot season that cow's milk is pure, *i. e.*, non-toxic, a sense of security can only be attained by the use of sterilized milk, the process of sterilization affording at least partial protection. Any other article of food employed should be sterilized, also all of the water employed.

Contaminated milk entering so largely into the etiology of the affection, and the introduction of any additional quantity of that fluid into the digestive tract only furnishing additional material for fermentation, the first essential in the treatment is to stop all milk preparations. In cholera infantum and acute entero-colitis it is necessary to give the organs entire rest for from twelve to twenty-four hours, which period of fasting may be followed by the use of whey prepared from sterilized milk, and given at first in small quantities. In the chronic diarrhœa, albumin-water, barley-water and light broths may be given. (See page 623.) Cholera infantum and acute entero-colitis being dependent upon an irritant poison within the gastro-intestinal canal, the effects of that poison should be negatived as soon as possible by its removal. This is to be done by washing out the stomach and by irrigation of the colon. For washing the stomach, no instrument is better than a soft rubber catheter used as a stomach tube. The clearing out of the large intestines requires very thorough attention. Boiled water, with or without castile soap, and in large quantities, may be used. The irrigations should be continued until the return flow of water is absolutely clear. These procedures should be repeated on the return of any degree of vomiting or purging. The only objection to be offered against them is their severity, and this is largely imaginary; still, they can scarcely cause as much suffering as do the symptoms they are intended to alleviate.

The child should in all cases be kept cool, but free from chilling. When its strength will permit of such a course, removal to a cool place or

a short trip on the water should be ordered. Cool sponging with gentle friction adds greatly to the chances of recovery.

The return to milk as an article of diet should be made with the greatest care. As a rule it is best to keep to the use of broths or starchy foods for several days.

Arsenicum is useful in all varieties of infantile diarrhœa, but is especially important as a remedy in cholera infantum, possessing in its symptomatology serous stools, violent vomiting and purging, intense thirst, restlessness and other general symptoms present in typical cases, and terminating in collapse. The *arsenite of copper* is also of first importance in these cases, the nervous symptoms and crampy pains being prominent features when it is indicated. It is an excellent remedy to begin the treatment of painful cases with sudden onset, if some other remedy is not clearly demanded. The second or third decimal trituration should be used. *Veratrum album* and *camphor*, both valuable remedies in cholera Asiatica, are also sometimes useful in cholera infantum, the former when the patient is bathed in a cold sweat, has violent pain or the pain has ceased, and the latter in the stage of pronounced collapse. I have observed remarkable results from *zincum metallicum* and from the *cyanide of zinc* in the stage of collapse, after cessation of the stools and of vomiting, with a cold, dry surface, sunken features, open eyes, subnormal temperature, and little response to external stimuli, even to flies crawling over the face and corneæ. This is a picture of a bad condition, but recovery has taken place under these circumstances from the sixth trituration and without the aid of other remedies or measures. *Secale* may be given where the prostration is great, the surface shrivelled, and although it feels cool to the hand, the patient will not remain covered. *Hydrocyanic acid* is another remedy applicable to cases in extremity, being called for when paresis of the digestive tube causes fluids to roll audibly downward. When this symptom is present vomiting and purging have generally ceased, the surface is cool, the pulse feeble and convulsions may appear. Of the officinal dilute acid ten drops should be added to four ounces of water, of which teaspoonful doses should be frequently repeated.

Turning to remedies suited to cases without choleraic symptoms, it may be stated that *aconite*, *belladonna*, *bryonia*, *ferrum phosphoricum*, and other remedies which antagonize the frank inflammatory process, may be useful in cases of this type when attended by a marked degree of fever in the early stage. *Aconite* is seldom useful after the first day or two, and then when the child is restless, has high fever, a great deal of thirst, hot, dry skin, etc.; *belladonna* when there are griping, greenish stools containing bloody mucus, some tenesmus, active fever, hot head, flushed face and drowsiness, but easily startled. It is a useful remedy for cases opening with convulsions. *Ferrum phosphoricum* is admirable for

catarrhal children who develop entero-colitis. Fever is marked, the patient is quiet, perhaps inclined to be drowsy, there is not much stomach irritability or tenesmus, but the stools are slimy and contain streaks of bright blood.

If the early inflammatory symptoms diminish, but the stools continue with griping pains, a good deal of mucus, perhaps blood, and tenesmus, it is best to give *mercurius dulcis* in the second decimal trituration every hour, which remedy will frequently bring about a marked change within twenty-four hours and may frequently be followed by a few doses of *sulphur*, which often proves to be all the medicine required. If results are not so favorable any one of the following medicines may be considered.

Antimonium crudum for general gastro-intestinal catarrh, the gastric symptoms being most prominent. There is a white tongue, much vomiting and less purging. It is suited to exceedingly irritable children.

Croton tig. is a remedy of the highest order in these cases. I have repeatedly observed prompt results after the failure of arsenic, which we often administer when the former medicine should be given. The stools are profuse, watery, yellowish and ejected suddenly and with force. There is aggravation after both food and drink.

Cantharis. Cantharis is indicated in serious cases presenting marked changes in the mucous membrane, consequently the stools are like scrapings of the intestines and may contain blood. There may be urinary symptoms and burning at the anus (if the patient is old enough to complain). The features are sunken and the patient intensely prostrated.

Ipecac. is useful in the first few days; *i. e.*, before marked tissue changes have occurred. Vomiting, severe colic below the umbilicus, and green or fermented stools are the important indications.

Iris. Although this remedy enjoys considerable reputation in the treatment of cholera infantum, it seems to be better adapted to entero-colitis, suiting cases which come on in hot weather and characterized by violent vomiting and purging, the vomited matters consisting of food and bile. The presence of bile is an important indication. There is a marked aggravation towards morning.

Podophyllum, like the former medicine, seems to be adapted less to cholera infantum than to entero-colitis. The stools are remarkable for their changeable appearance, although my personal experience leads me to state that the characteristic stool consists of greenish or yellowish, thin, even watery matter, with aggravation in the morning. Prolapsus ani is a common attendant of these cases.

For the treatment of persisting cases of entero-colitis some suggestions may be gained from the article on chronic diarrhœa.

ENTERALGIA.

Nomenclature.—Enterodynia and colic are generally regarded as synonymous with enteralgia. However true this may be as a clinical fact, these terms certainly have etymological differences, which, however, cannot be recognized in practice. We must admit theoretically the possible existence of a pure neuralgia of the intestine, but examination of nearly all cases likely to prove such show the pain to be dependent upon causes to be enumerated.

Definition.—The ordinary definition of enteralgia—neuralgia of the bowels—fails to cover the class of cases usually included under this title. Clinically, enteralgia is intestinal pain occurring independently of any local changes in the intestines, inflammatory or otherwise, arising usually from local or reflex irritation in persons who are abnormally susceptible to such agencies.

Etiology.—The causes of enteralgia are general, local and central. Of the first named, two stand forth with especial prominence, the neurotic and gouty diatheses. The disease is by no means uncommon in hysterical and neurasthenic individuals, especially under the influence of exciting causes acting directly upon the nervous system, including among these violent emotions, prolonged anxiety, excessive mental labor, etc. In most of these cases the pain seems to originate in an abnormal excitability of the sensory nerves of the intestines without the intervention of an unusual exciting cause. Enteralgia is often observed as a manifestation of gout. Succeeding the intestinal pain, the articular phenomena of that disease may develop, or arthritic and neuralgic phenomena may alternate. Potain assumes that gout is a very common cause, and speaks of enteralgia as a "neurosis of arthritic origin." Some cases are strictly rheumatic and occur as the result of exposure to wet or cold.

The local causes are found in irritation of the intestines by their contents. The offending substances may consist of improper food, imperfectly digested products of disordered digestion, accumulations of flatus, or foreign bodies in the bowels. Among the latter are gall-stones, enteroliths, intestinal parasites of great variety, seeds and stones of fruits, and fæcal impactions. Some patients experience severe paroxysms of enteralgia because of an idiosyncrasy towards certain articles of diet which are without deleterious effects in the majority of cases. Among such articles are to be enumerated shell-fish, veal, ice-water, strawberries and ice-cream.

Many abdominal diseases acting reflexly produce severe paroxysms of intestinal pain. The organs most likely to exhibit offense in this direction are the liver, kidneys, spleen, pancreas, uterus and ovaries.

"Central causes" embrace diseases of the brain and spinal cord.

The lightning pains of ataxia sometimes involve the intestines, as they do the stomach, producing gastric crises, and spinal caries is a source of many obscure cases of enteralgia. Hypochondriasis is associated with many cases.

Anæmia, and poisons like lead, arsenic and copper are responsible for some cases.

Symptomatology.—The essential symptom of enteralgia is a severe abdominal pain centering about the umbilicus and radiating thence in any or all directions. It may come on suddenly or gradually, generally the former, and is not infrequently preceded by loud rumbling of gases within the intestines. The pain itself may be either dull or severe. When the suffering is intense, the patient is thrown into a profuse sweat, which may be either cold or hot; the face exhibits a pale, anxious appearance. Relief from pain is generally secured by flexing the thighs on the abdomen and exerting firm pressure over the painful area. In some cases the opposite condition obtains, pressure either firm or light, increasing the suffering. The duration of the paroxysms is variable. As a rule the more severe the pain, the sooner will the attack be over. As to the frequency of repetition, this will likewise be most variable. In some, attacks come on after any exposure to one of the exciting causes already enumerated; in others they recur periodically under the influence of some constitutional cause, as the neurotic and gouty diatheses.

Inspection of the abdomen may show either distention or retraction. The accumulations of flatus passing through the intestinal tract excite exaggerated peristaltic movements which are often visible through the abdominal walls.

Concomitant symptoms arise reflexly in many cases, and consist of hiccough, vomiting, strangury, priapism, retraction of the testicles, vertigo, fainting, and it is said, even convulsions.

Diagnosis.—The diagnosis of enteralgia includes the determination of two points, the differentiation of this affection from those which simulate it more or less closely, and the discovery of the cause to which the paroxysms are due. From enteritis it is differentiated by the usual relief of pain on pressure, the absence of fever, the suddenness of the attack, and the freedom from pain between paroxysms; from intestinal obstruction by the stercoraceous vomiting, obstinate constipation, and the localized pain and tenderness of that affection; from rheumatism of the abdominal muscles, by the superficial pains, the aggravation in damp weather, the non-paroxysmal character of the pain, and the aggravation on movement, which marks the latter affection.

Enteralgia from indigestible food is nearly always preceded by symptoms which point to disturbances of the stomach. When due to accumulation of fæces, physical examination sometimes reveals the pres-

ence of that condition, and there is a history of constipation. Enteralgia from worms can only be diagnosticated on the discovery of the parasites in the stools. Gouty cases are detected especially by the family and personal history of the patient, the occurrence of seizures without any antecedent indiscretion in diet, and the subsequent replacement of the abdominal pain by gouty involvement of the joints. Hysterical cases are accompanied by superficial hyperæsthesia, which may disappear, or at least is not aggravated by deep firm pressure. Then, too, there are the characteristic hysterical symptoms, emotional temperament, globus hystericus, etc.

Prognosis.—The prognosis of enteralgia is favorable. No uncomplicated case ends fatally. Recovery from the tendency to the attacks is nearly always possible on discovery and removal of the cause.

Treatment.—The management of a case of enteralgia on causal indications is to be conducted on the ordinary principles of hygiene and according to the advice given elsewhere in this work, in sections devoted to the special consideration of the etiological conditions, viz., gout, hysteria, rheumatism, constipation, etc. During the attack the majority of cases do very well under applications of dry or moist heat and the administration of a symptomatically indicated remedy. Hot baths are of decided benefit and may make the use of a narcotic unnecessary. The bowels should be moved by means of a large hot injection. Sometimes the suffering is so intense, and exerts, moreover, such a severe effect on the patient's general condition, that the inhalation of a little chloroform, or the hypodermatic administration of from one-eighth to one-quarter of a grain of morphia becomes a positive necessity in the absence of relief from less heroic measures, but the importance in all forms of neuralgia of avoiding the repeated use of opiates, cannot be too frequently reiterated.

The remedy best adapted to the majority of cases, *i. e.*, the one corresponding most closely to the characteristic clinical picture of enteralgia, is *colocynth.* The pains find marked relief from pressure and bending double. This remedy is adapted to rheumatic, gouty and neurotic cases. In enteralgias dependent upon disordered digestion *nux vomica* is the most important remedy. Associated with the pains are the characteristic gastric symptoms of that remedy, together with accumulations of flatus, which by pressure cause shortness of breathing. The bowels are constipated and there is ineffectual urging to stool. If hæmorrhoids are present nux is indicated still more strongly. In enfeebled neurotic persons one-grain tablets of *strychnine* 2x, repeated four times daily, are often serviceable. *Belladonna* is suited to cases dependent upon accumulations of flatus, mainly in the colon, the symptom in the materia medica reading "transverse colon stands out like a pad." It is more valuable for pain of a typically neuralgic character, involving the central

parts of the abdomen and characterized by rapid onset and departure of the pain. *Arsenite of copper* has proven of first importance for attacks excited by imprudent eating, after shell-fish, or when there was excessive peristalsis apparent. *Chamomilla* is also adapted to flatulent cases, especially in children. The pains have the same general characteristics as those calling for colocynth, but they are associated with hot sweat, irritability and flushed cheeks. *Lycopodium* is applicable to flatulent colic occurring in lithæmic constitutions. Rheumatic cases find useful remedies in *veratrum album* and *rhus tox.* Both of these drugs have the colocynth characteristic, viz., relief from bending double; both also have relief from moving about; in the veratrum case the patient is bathed in a cold sweat. *Aconite* and *dulcamara* are adapted to rheumatic cases caused by exposure to wet, cold weather. *Plumbum* is valuable especially in chronic cases of enteralgia with obstinate constipation, scanty urine and marked retraction of the abdomen. It is not excluded from the treatment of acute cases, however. One must make sure that these cases are not due to the action of lead; if they are, opium is useful. Most of the remedies indicated during the attacks exert a permanently curative action if administered during the interparoxysmal period.

The position of *dioscorea* has been in doubt, but there is evidence that it is of value in true enteralgia.

Arsenic is effective in some chronic cases dependent upon diathetic conditions or malaria; or in anæmic, neurotic individuals. Acute attacks dependent upon taking cold articles are said also to be combated by this remedy.

INTESTINAL CANCER.

Etiology.—Cancer of the intestines is a very rare disease, constituting, according to different statistics, from four to eight per cent. of all cases of malignant growths. These figures include cancer of the rectum, which is more frequently encountered than cancer of all other portions of the intestinal tract collectively. The disease occurs nearly always in persons at or beyond middle life, though children are not exempt. Heredity has been assigned as a cause, but does not seem to receive the support of clinical facts. Local irritation apparently has an important bearing in the production of the disease, as indicated by the special frequency with which the malignant process invades the flexures. The influence of mechanical irritation in the production of cancer is further exhibited in those cases in which the disease starts in old cicatrices, as instanced in Waldeyer's case, in which one year after an ovariotomy the portion of the intestines which had become attached to the pedicle, became cancerous.

Pathology and Morbid Anatomy.—The pathology and morbid anatomy of cancer of the intestines is essentially the same as that of this

disease when it involves the stomach. The principal varieties are scirrhous, encephaloid, colloid and cylindrical-celled epithelioma. The large intestine is involved with far greater frequency than is the small, and the disease is especially apt to attack the sigmoid flexure. Cancer of the small intestine is particularly apt to involve the duodenum.

Intestinal cancer is nearly always a primary disease, secondary growths being comparatively rare. Sometimes it occurs by extension of the disease from contiguous viscera. The morbid growth begins in the mucous membrane, whence it extends in depth and area until it involves all the coats and the entire circumference of the bowel. Reaching this stage it causes a narrowing of the intestinal lumen and becomes a cause of intestinal obstruction. Ulceration sooner or later takes place. Sometimes perforation follows, the result varying according to the structure thus invaded.

Symptomatology.—Cancer of the intestines has no well-defined symptomatology. Some cases go on for a long time without any indications of the serious trouble impending. Probably the first symptom of any note is localized pain, which is very persistent, or again, the pain may be of a vague character, but exhibiting a tendency to a maximum intensity at a particular spot. Irregularity of the bowels is often an important feature. Constipation is the usual condition, due not only to the narrowing of the intestinal lumen by the tumor, but also to the paresis of the muscular coat by the annular growth. Irritation of the bowel by the growth sometimes produces diarrhœa, which alternates with the constipation. In advanced cases the appearance of the stools gives important information. They are found to contain blood, pus, and a fluid possessed of a highly gangrenous odor. The fæcal masses are often altered in shape owing to the narrowed passage through which they are obliged to pass. Thus they are discharged as small round balls or as ribbon-like bands, changes which are especially apt to occur in the case of cancer of the rectum.

After the disease has continued for awhile, its constitutional effects are asserted. The patient assumes a cachectic appearance and emaciates rapidly. By this time, too, physical examination nearly always enables us to discover the presence of a tumor, the characteristics of which vary according to circumstances. Thus it may be either fixed or movable according to the portion of the intestine involved. Occurring in the colon or small intestine it is especially movable. Leube assumes that "a frequent change in the position of the tumor and in the distinctness with which it can be felt in consequence of the shifting of the intestinal convolutions over each other, a temporary accumulation of fæces, etc.," "is to a certain degree characteristic of intestinal cancer." The size of the tumor as observed during life is much greater than its actual dimensions, because of the accumulation of fæces above its site. Very often,

indeed, in order to correctly appreciate the physical condition, it is necessary to thoroughly empty the bowels. The cancerous tumor is sensitive; it does not indent on pressure, and on percussion it gives a dull tympanitic sound.

Diagnosis.—Two questions are involved in the diagnosis of intestinal cancer, the recognition of the existence of the growth and the determination of its location. Both of these are very uncertain clinical problems. The existence of the cancer can only be determined with certainty when it has advanced to the stage at which localized pain, intestinal obstruction, irregularity of the bowels, cachexia and a palpable tumor, are all present.

Cancer of the duodenum simulates very closely malignant disease of the pylorus; in fact, when the growth involves the upper portion of the duodenum a differentiation during life may be impossible. Involving the lower portion, the interference with the function of the bile and pancreatic ducts is manifested clinically by jaundice and the presence of undigested fat in the stools.

The lower the portion of the intestinal tract involved, the more likely are constipation and tympanites to be observed.

Cancer of the small intestine, and to a less degree of the colon, is characterized by the remarkable mobility of the tumor.

Cancer of the sigmoid flexure is often attended by œdema of the left lower extremity from the pressure of the tumor on the large veins supplying that member. The stools are often scanty and slightly fæcal in character, horribly offensive in odor, and containing blood and pus.

In cancer of the rectum local examination reveals the presence of the tumor. Constipation is obstinate. Every movement is attended by intense local pain. The stools are flattened and ribbon-like in many cases. Sometimes there is more or less constant oozing of a sanious fluid from the anus.

Portions of the intestinal growth may be discharged in the stools. The microscopical examination of such particles renders it possible to make a positive diagnosis.

Prognosis.—The prognosis of cancer of the intestines is absolutely unfavorable, death resulting in from six months to three years after the onset of the disease. The fatal issue is brought about, as a rule, by exhaustion, occasionally, however, ulceration and perforation lead to secondary states, as peritonitis, thrombosis, embolism, or pyæmia, which speedily bring about a disastrous termination. Accidental circumstances sometimes intervene to bring about a temporary improvement. Thus two portions of intestine between which the tumor is situated may become adherent and perforate, establishing in this manner a free passage for the intestinal contents. In some cases portions of the tumor ulcerate and slough off, and again the passage is clear; and in still other cases the

advancement of the disease in the direction of the external surface leads to the production of an artificial anus through which fæcal matters are readily expelled.

Treatment.—Therapeutic measures designed to relieve suffering are all that can be adopted. Severe pain will call for the use of morphia. Obstinate constipation is to be relieved by the use of enemata. The diet should be of a character that leaves but little fæcal residue. If the tumor is situated in the small intestines rectal alimentation affords a most excellent means of nourishing the patient, and of lessening the irritation of the growth. When the tumor is in the sigmoid flexure or the rectum, daily douching of the lower bowel for purposes of cleanliness is necessary. Cancer of the rectum permits of excision in many instances.

Remedies which have been found of most value in mitigating the symptoms of cancer generally have been commented upon in various sections, notably in the article on cancer of the stomach. Reference may also be made to the articles treating of constipation and diarrhœa.

INTESTINAL HÆMORRHAGE.

Intestinal hæmorrhage, also called enterorrhagia, is but a symptom of a great variety of morbid conditions, most of which will be found fully described in other sections of this work. Sometimes it occurs so unexpectedly, assumes so alarming a character, and demands such prompt measures for its relief, that the needs of the practical physician require a section devoted to its consideration.

Etiology and Pathology.—The pathological causes leading up to intestinal hæmorrhage include (1) abnormal contents of the bowels, (2) diseases of the intestinal bloodvessels, (3) diseases of the intestinal walls, (4) systemic affections producing marked alterations in the composition of the blood, and (5) diseases of various viscera leading to irregular distribution or marked increase of blood pressure. Among the abnormal contents of the bowels must be mentioned impacted fæces, which by the local irritation excited may readily, in the predisposed, lead to a vascular tear or rupture. Foreign bodies swallowed, especially those possessed of sharp outlines, as fishbones, pieces of oyster-shell, false teeth and other articles too numerous to mention in detail, have a like dangerous effect. A rare cause is intestinal parasites, especially the anchylostomum duodenale. Owing to the infrequency with which these, as well as other exciting causes produce hæmorrhage from the bowels, it would seem necessary that degeneration of the vascular walls is requisite to make them operative. Amyloid degeneration and aneurism are here worthy of especial mention. Prominent among the diseases of the intestinal walls must be noted ulcerations, especially those appearing during the course of typhoid fever, tuberculosis, syphilis, dysentery and intestinal catarrh. Hæmorrhage is also one of the symptoms of malignant disease.

Inasmuch as cancer is situated in the rectum far more frequently than in any other portion of the intestinal tract, hæmorrhage from this cause is usually readily diagnosticated. Intestinal polypi in children have a marked hæmorrhagic tendency. Embolism of the mesenteric vessels, in a number of instances, has produced intestinal hæmorrhage. Quite a variety of infectious fevers have enterorrhagia as one of their symptoms, due nearly always to alterations in the composition of the blood and impaired nutrition of the vessel walls, the localization in the intestines not being related to local causes. Here, yellow fever, variola, pyæmia, erysipelas, and typhus are deserving of especial mention. Among the non-infectious diseases pernicious anæmia, leukæmia, hæmophilia, purpura hæmorrhagica, scurvy, and acute fatty degeneration, produce this symptom from the same cause, the *modus operandi*, however, being different. Alterations in the intestinal blood pressure occur in diseases of the kidneys, liver, heart, and lungs. In the case of renal affections they are but part of a general increase in blood pressure, and are usually combined with diseased arteries. The influence of the liver acting through disturbed portal circulation will be fully elaborated in speaking of the affections of that important gland. Diseases of the heart and lungs are as likely to disturb the intestinal circulation as that of other portions of the body.

Symptomatology.—The recognition of intestinal hæmorrhage depends upon the appearance of blood in the stools. Prior to this occurrence certain suggestive symptoms are observed which can only be regarded as diagnostic when occurring in connection with the existence of a known cause of hæmorrhage from the intestines. The first of these symptoms is abdominal pain, which may or may not be associated with a feeling as of a warm fluid flowing into the abdomen. Then come the characteristic symptoms of hæmorrhage in general (if the case be a severe one), *i. e.*, pallor of skin and mucous membranes, weak pulse, tinnitus, dark spots before the eyes, and faintness. Some cases end fatally at this stage. In others the blood escapes at the anus, its appearance depending very largely on the length of intestinal canal it has had to travel before effecting its escape. When the hæmorrhage is high up in the small intestines, or has been retained for a long time in the canal, it is apt to be dark-brown or tarry in appearance; when from the large intestine it is pure and unaltered, as if from an external wound.

Diagnosis.—Ordinarily the recognition of blood evacuated with stools is an easy matter. Sometimes, however, mistakes are possible by reason of the patient having swallowed some dye, or taken a medicine like iron, which discolors the stools, or by the expulsion of stools consisting largely of bile. In all such cases, the microscopic and chemical tests for blood mentioned in the chapter on the examination of that fluid determine the nature of the discharges.

It is often possible to determine the portion of the canal whence the blood proceeds. When it is found simply on the outside of the fæcal masses, there can be no doubt of its rectal origin; when intimately mixed with the stools, and of a dark tarry character, it comes from the small intestines; when from the duodenum, there is nearly always associated hæmatemesis. The cause of the hæmorrhage aids considerably in determining its location. Thus, in typhoid fever, it is generally from the ileum; in dysentery, from the large intestine. Whenever pure blood is passed at stool the rectum should be carefully examined for hæmorrhoids, anal fissure, etc. Purpura hæmorrhagica, leukæmia, and pernicious anæmia are recognized as causes by the clinical features of the blood, as explained elsewhere.

Prognosis.—The prognosis depends largely upon the persistence of the bleeding, the quantity of blood lost, and the character of the primary lesions. Persistent hæmorrhage from any cause is always a serious matter. Some fatal cases are due to a large loss before the blood appears externally and is discovered. That from hæmorrhoids can generally be controlled before any serious damage has been produced. For further information regarding the prognosis of hæmorrhage, due to typhoid fever, and the various affections which excite it, consult the several articles devoted to their consideration.

Treatment.—The first element in the treatment is absolute rest, not only of a general character, but of the gastro-intestinal canal in particular. It is best to prohibit all food at first, and later, when the bleeding has been controlled, to permit only cooled liquids for several days. To quiet intestinal peristalsis, opium or morphine should be given. The injection of styptics is rarely efficient, as the lesions are often situated beyond their reach. Applications of ice are of doubtful value, for the direct effect of the cold does not penetrate sufficiently promptly to the *locus mali*, besides being open to the objection of increasing the hæmorrhage by stimulating intestinal peristalsis. When collapse threatens, hypodermic injections of ether and transfusion of a normal salt solution, according to Northrop's method, are indicated. When arterial tension is high, *glonoin* first centesimal should be given in one-drop doses every one to three hours, unless the physiological effect of the drug is too great. The remedies ordinarily efficient are *ipecacuanha*, *terebinthina*, and *hamamelis*. These are adapted to cases not attended by alterations in the composition of the blood; *ipecac.* when associated with nausea; *hamamelis*, when the blood is venous, and *terebinthina*, when there is evidence of ulceration, especially in typhoid fever, and in the enterorrhagia of renal disease. In hæmic disorders, *arsenicum* and *phosphorus* are the main remedies, and for the hæmorrhage of the acute infectious diseases, *crotalus*, *sulphuric acid*, and *carbo veg.*

I have recently employed *hydrastinine hydrochlorate* with remark-

able results in both passive and active bleeding, giving the second decimal trituration, or one-quarter to one-eighth grain hypodermatically.

During convalescence the patient should receive *cinchona* in the mother tincture, or *ferrum*. At the same time the greatest discretion regarding the diet should be exercised, it being unwise to permit an early return to solid food, and later only by degrees, until all possibility of relapse has passed by.

INTESTINAL OBSTRUCTION.

Definition.—Intestinal obstruction is a condition dependent upon a variety of pathological states all of which act mechanically to obstruct more or less completely the onward passage of fæces through the intestines.

Classification.—The attempts made to systematize the study of the lesions producing intestinal obstruction have led to a variety of classifications, some with and some without value. A division into congenital and acquired cases is simple enough, but lacks completeness. The former includes obstruction dependent upon a variety of deformities, *e. g.*, imperforate anus, absence of portions of the intestinal tract, obstruction by the formation of bands from intra-uterine peritonitis, etc., and the latter a number of lesions which will be described in succeeding paragraphs. Another classification is based on the structure whence the obstruction proceeds, whether from within or without the canal, and still another on the character of the pathological lesions producing the condition. While the latter has the merit of being the best for clinical purposes, the former is possessed of considerable value, and is presented herewith for study. The obstructing lesion may act from within the intestinal lumen, from the walls themselves, or from the surrounding structures. The conditions within the lumen producing obstruction are fæcal impaction, enteroliths and foreign bodies; causes acting in the walls are malformations, paralysis of the muscular coat, inflammation, cicatrices and tumors; from without the walls, enlarged viscera, tumors, and displacements. Displacements acting within the walls include volvulus and intussusception; displacements from without, hernia, and the strangulation of the gut by constricting bands.

From a strictly pathological basis, intestinal obstruction may be studied as arising from intussusception, volvulus, internal strangulation by constricting bands, impaction of fæces and foreign bodies, functional obstruction and tumors.

Etiology and Pathology.—Intestinal obstruction then arising from a variety of pathological lesions, a study of its etiology and pathology requires a study of such primary lesions *seriatim*.

Intussusception. This condition, also known as invagination of the bowels, is a state in which one portion of the intestines enters a

contiguous portion by a peculiar method of folding. It is a very frequent cause of intestinal obstruction, especially in children. Fitz's statistics showed 93 out of 295 cases to be due to this cause; and Leichtenstern's, 442 out of 1,152. An examination of an invaginated portion of intestine shows it to consist of three layers so arranged that serous membrane comes in contact with serous membrane, and mucous membrane with mucous membrane. For convenience of study the various parts making up the abnormality have received special designations. The portion of intestine receiving the displaced part is called the sheath or the *intussuscipiens;* it is the most external of all the layers. The invaginated part is called the entering layer or the *intussusceptum;* it is the innermost layer. The middle one is called the returning layer. In the formation of an invagination the upper portion of the gut nearly always enters the lower. Any increase in the deformity is always at the expense of the outer layer, the same point ever remaining the apex of the intussuscipiens.

In actual practice the physician has to do only with intussusception producing obstruction of the bowels; but at autopsies another variety is often found, one which takes place during the last hours of life and which is known as the intussusception of the dying. It is due to a feebly tumultuous action of the intestines during the death struggle, and produces no symptoms. These intussusceptions are always slight, and are replaced with little difficulty. They are frequently multiple, and just as often as otherwise, the invaginated portion of intestine is the lower.

The immediate cause of intussusception is irregular peristalsis, a fact positively proved by Nothnagel's experimental investigations. This irregular action may be due either to spasm or paralysis of the intestinal muscularis. Treves believes that when once an invagination has taken place, the intussuscipiens acts as a foreign body, irritating the sheath, stimulating irregular contractions to a still greater degree, thus increasing the lesion. The exciting cause of the irregular peristalsis is not always determinable. In the majority of cases the obstruction seems to occur idiopathically, so to speak. On the other hand a respectable minority of cases gives a history of diarrhœa, enteritis, exposure to cold, injuries, and a variety of acute ailments.

In the majority of cases only one intussusception occurs; exceptionally only are they multiple. An important atypical variety is that in which the infolding of the intestinal walls is double, triple, etc. In these cases the ordinary intussusception with three layers forms; when a portion of the sheath undergoes an additional invagination, and so the lesion comprises five layers.

Ordinarily but a few inches of intestine are involved in the pathological process, but remarkable exceptions have been noticed, especially in children, a number of feet of intestine becoming telescoped into the bowel below. Cases have even occurred in which the displaced portion

appeared at the anus and was removed as a polypus. In one case in which this error was made, the patient recovered not only from the intestinal obstruction, but also from a chronic constipation which had tormented him for years.

According to the seat of the invagination, intussusception has been divided into ileo-cæcal, when the ileo-cæcal valve passes into the colon; ileal, when the ileum passes through the ileo-cæcal valve; colic, when one portion of the colon passes into the succeeding portion; colico-rectal, when colon and rectum are thus involved.

To the casual observer intussusception does not seem capable of producing the complete obstruction which so frequently accompanies it; and yet there is a ready explanation. Cases have indeed occurred where this condition has given rise to a variety of abdominal symptoms, but without evidence of the slightest interference with the intestinal lumen. In the majority of cases obstruction follows promptly, and this is brought about by alterations or constriction in the calibre of the entering layer by the dragging of the mesentery, by thickening of the intestinal coats, by the resulting congestion, inflammation and exudation, and the further blocking of the narrowed passage by some portion of the intestinal contents, which, under normal circumstances, would have been innocent of harm-doing.

Early in the history of the case, invaginations are, as a rule, readily reduced. Ere long, however, inflammation is set up, usually a localized peritonitis, producing adhesions between the peritoneal folds of the lesion, especially at the orifice. This new complication may involve the entire surfaces of the inner and middle layers. The older the case the more likely is the displacement to be rendered irreducible. Sometimes the receiving layer undergoes secondary changes, *e. g.*, congestion, which so increases its calibre as to make its removal through the orifice of the receiving layer impossible, and, in still other cases, irregular peristalsis may have so changed the positions of the component parts of the intussusception, as to render reduction impossible.

The affected portion of the bowel undergoes still further changes with time. The nutrient blood-supply is seriously interfered with, the tissues becoming livid, or cyanotic; finally, gangrene supervenes.

When the intussusception does not completely obstruct the bowel, the condition becomes chronic, producing a variety of symptoms presenting few characteristic features, which may continue over a term of years.

Internal Strangulation. The anatomical factors, producing internal strangulation, are, in nearly every instance, the result of old attacks of peritonitis. They include adhesions of one portion of the bowel to another, or to one of the neighboring viscera, cords produced by the stretching of old adhesions, strangulation through abnormal attachment of Meckel's diverticulum, of the appendix vermiformis, or of the

Fallopian tubes, and strangulation through entrance of a portion of the intestine into apertures in the mesentery and omentum. Internal strangulation is also a frequent source of intestinal obstruction, the statistics of Fitz and Leichtenstern assigning it a frequency of 35 per cent. of all cases. It occurs more frequently in males than in females, and especially in subjects between the ages of twenty and forty years. The patients often give a history of previous peritonitis, abdominal injury, or other abdominal disease. The interval elapsing between the time of the peritonitis and the strangulation varies greatly, the extremes reported being five weeks and twenty-one years; the average interval is three years.

The obstruction takes place by reason of the constriction of a portion of the intestine, usually the ileum, by a fibrous band, free at one extremity, which may form a simple loop, or a most complicated knot. When both ends of the cord are attached, the bowel gets beneath, and is caught as by a low archway. The same mechanism exists in the case of strangulation by normal structures abnormally attached, as the Fallopian tubes and the appendix. The strangulated intestine is deprived of its blood-supply and its walls ultimately become gangrenous. Sometimes the constricting band undergoes these same changes in nutrition and sloughs off.

Volvulus. By this term is meant a twist or knot in the bowel. It is an infrequent cause of intestinal obstruction, comprising, according to Treves, about one-fortieth of all cases, hernia excepted. It is more frequent in men than in women and in persons between the ages of forty and sixty years. Its subjects commonly give a history of obstinate constipation over a long term of years. The twist or knot is most frequently encountered in the sigmoid flexure, and next in the cæcum. The twisting of the part takes place about its mesenteric axis, and the portions of the bowel crossing each other become strangulated. The twist is usually through an arc of from 180 to 360 degrees, but one in which the gut is wrapped about itself two or even three times is by no means improbable. A volvulus thus formed has but little tendency to unfold itself. The occluded portion of the bowel soon becomes distended with gas, and its walls are engorged with blood, these conditions tending strongly to fix the displacement. Even at an autopsy, when the volvulus is untwisted by the hand, it exhibits a marked tendency to spring back immediately to its abnormal position unless the distention be first relieved. Ultimately, as in other forms of intestinal obstruction, peritonitis supervenes, adhesions form, which give the displacement still firmer fixity.

Strictures and Tumors. Strictures and tumors cause chronic far more frequently than they do acute obstruction. Thus of 295 cases collected by Fitz, there were 15 arising from this cause, and of these but one was of acute obstruction. Strictures of the intestines are either

congenital or acquired, and when the latter, are produced by cicatrization of ulcers or by cancerous infiltration of the walls of the gut. The character of ulceration giving rise to these cases is most varied; thus it may be typhoid, dysenteric, catarrhal, peptic, syphilitic, or tuberculous. Sometimes stricture occurs in a portion of intestine that has been involved in strangulated hernia, and is due to the cicatrization consequent upon an ulceration or localized gangrene of the affected portion of the bowel. Some cases of intestinal stricture undoubtedly arise from traumatism. Congenital stricture is situated most frequently in the rectum or sigmoid flexure, and is generally the result of a prenatal peritonitis. The stricture may involve almost any portion of the intestinal tract. Of the 78 cases collected by Treves, 26 were of the small intestine, 8 of the ileo-cæcal valve, and 44 of the colon. The cases produced by cicatrices occurred in subjects ranging in age from 9 to 65 years; the cancerous cases, from 22 to 76 years. The previous history of all these cases of cicatricial stenosis does not seem to give as much information as one would expect. A history of dysentery is, of course, of considerable value in pointing to a conclusion in this direction. As to other ulcerations, they occur so rarely and their recognition is always so uncertain that a history of them can only be suggestive. Cancer as a cause of obstruction nearly always invades the rectum. It appears as an annular growth. Sometimes portions of the tumor ulcerate and slough away, relieving the obstruction.

Abnormal Contents Including Foreign Bodies and Impacted Fæces. The foreign bodies which may give rise to intestinal obstruction are articles accidentally swallowed, as false teeth and various concretions, as gall-stones and enteroliths. The majority of foreign bodies swallowed are passed *per vias naturales* without doing damage. Sometimes, however, they are retained, and although of themselves insufficient to obstruct the intestinal calibre, give rise to secondary changes and thus ultimately produce dire results. Others do damage by their accumulation, as in the case of obstruction by large masses of fruit-stones and seeds, reported from time to time in medical literature. Gall-stones likewise pass readily after their escape from the gall-bladder; but sometimes masses of these concretions ulcerate their way into the intestine and are too large to be passed onward. They are generally found in the ileum or above the ileo-cæcal valve. Obstruction by gall-stones is found more frequently in women than in men, and especially in those who have passed middle life.

Enteroliths are rarely the cause of intestinal obstruction in man. Still they do occur. One case of this kind was recently seen by Drs. Bartlett and Van Lennep. Bimanual palpation disclosed the presence of a hard body of unknown character at the ileo-cæcal region. Operation was refused and the patient died. At the autopsy an enterolith was

found in this situation, and the anatomical conditions were such that its removal would have been a very simple matter. I have knowledge of a second instance, the case being diagnosticated by many eminent physicians as carcinomatous, the error being discovered at the autopsy.

Akin to obstruction from foreign bodies are those cases in which accumulations of bismuth, magnesia and other drugs are found.

Impaction of fæces results from chronic constipation or from paralysis of a segment of the bowel. Fæces thus accumulated are dried by absorption of their fluid constituents, and form large tumor-like masses, generally in the sigmoid flexure. They may by their presence excite ulceration with its secondary changes, still further complicating the condition.

Symptomatology of Intestinal Obstruction.—The clinical picture presented by acute cases differs so greatly from that of the chronic that the symptoms of the two are best considered separately.

(*a*) Symptoms of Acute Obstruction. In nearly all cases the symptoms appear suddenly in the midst of apparently good health. Sometimes the patient gives a history of preceding diarrhœa, constipation or slight abdominal pain, none of which has been sufficiently severe to demand much attention. Pain is usually the first symptom. It sets in suddenly, and is of agonizing severity. It is nearly always localized in one part of the abdomen, its position, however, bearing no definite relation, as a rule, to the situation of the obstruction, although Gay and others think differently. It persists throughout the entire attack, although later it does not have the severity it at first exhibited. Before death it sometimes disappears. Exceptional cases in which pain was absent, or at most an unimportant feature, have been reported.

Vomiting appears almost as soon as does the pain. At first the ejected matters consist of food and mucus. Later they are possessed of an intestinal odor, and finally they are stercoraceous. Fæcal vomiting usually sets in from the second to the ninth days, the average being the fifth day. Cases in which stercoraceous vomiting is not observed die at too early a period for that symptom to appear or are not of the ordinarily severe acute character. The vomiting increases in severity the longer the obstruction continues. It always persists until the obstruction is relieved or the patient dies.

Tenderness of the abdomen is not an initial symptom. Its advent generally marks the beginning of a localized peritonitis. It is a symptom of considerable practical value, as its location generally coincides with the seat of obstruction. In some cases the inflammatory exudate is sufficiently great to form a fairly well-defined tumor which may be made out by palpation.

Constipation of the most obstinate character is often present from the inception of the attack. In some cases there may be a movement of

the bowels, the fæcal discharge, however, having been in the portion of the bowel below the obstruction. In the majority of cases the lesion seems to act paralyzingly on the intestinal tract below, so that absolute constipation prevails. Treves has observed several cases in which a stool occurred on the day before death, and he believed that "its evacuation was coincident with the appearance of a general peritonitis." In addition to constipation there is entire retention of flatus.

Tympanites is more or less marked according to the height of the obstruction in the intestinal canal. When in the upper portion of the small intestine, tympanites is slight; when in the large intestines extreme.

Constitutional symptoms are present from the beginning. Prostration, which may increase to a profound collapse, is an early phenomenon. The patient is restless, his features pinched, face cold, eyes sunken, voice weak and his body bathed in a cold sweat. The pulse is weak and rapid and the temperature usually subnormal, pyrexia being suggestive of the appearance of peritonitis as a complication. Respirations are rapid and superficial. The tongue is at first coated white, and then becomes dry and brown. The urine is diminished in quantity and may be suppressed.

(*b*) Symptoms of Chronic Obstruction. The symptoms in chronic cases are not very characteristic. The diagnosis must be based in great measure on physical examination which will discover a cause for the trouble. The patient gives a history of long-standing constipation. Alterations in the shape of the stool, *e. g.*, ribbon-shaped, furrowed on one side, etc., have been reported, but must not be regarded as conclusive or necessary evidence of obstruction. There is also long-continued ill-health, with symptoms pointing to the abdomen as the seat of difficulty. Abdominal pain occurs in paroxysms from time to time. Vomiting may or may not be present. Gradual failure of health sets in and the patient ultimately dies of exhaustion or symptoms of acute obstruction set in suddenly and death ends the scene.

Diagnosis.—The diagnosis of intestinal obstruction resolves itself into the recognition first, of the actual existence of obstruction; secondly, of its character, and thirdly, of its situation. Under ordinary circumstances the determination of the existence of obstruction is an easy matter. Circumstances will arise occasionally in which the problem cannot be decided off-hand. *Acute enteritis* does not, as a rule, bear any great resemblance to obstruction, and yet Osler mentions a case with relaxation of the intestinal coils, vomiting and pain, in which acute obstruction was suspected, and yet at the autopsy the intestinal tube was found pervious throughout. The symptoms of occlusion are marked by their suddenness of onset and the associated collapse with low temperature, conditions which do not exist in enteritis. In the fully developed state the obstinate constipation and the fæcal vomiting dispel all doubt.

Peritonitis is early attended by fever and abdominal tenderness in association with the pain. That variety of the disease caused by perforation of the bowel is the one most liable to give rise to diagnostic errors. The symptoms of both conditions are of sudden onset, but in perforative peritonitis the pain, vomiting, etc., are preceded by evidences of other diseases, as appendicitis, ulceration, etc. Vomiting is very rarely fæcal in peritonitis, and while constipation exists in that disease, it does not assume the absolute character observed in occlusion.

Acute hæmorrhagic pancreatitis has, in the experience of Osler, simulated obstruction. In the case in question laparotomy was performed, but nothing was found but a "tumor-like mass surrounding the pancreas, firm, hard, and deeply infiltrated with blood." The patient recovered.

During cholera epidemics this disease and intestinal obstruction have frequently been mistaken one for the other.

The differentiation of the different varieties of occlusion can only be made approximately. *Intussusception* occurring for the most part in children, and constituting in them by far the largest proportion of cases of intestinal obstruction, is always to be suspected in them when the sudden advent of pain, fæcal vomiting, constipation and collapse indicate occlusion of the intestinal tube. Sometimes a tumor, situated generally in the right iliac fossa, can be detected about the third day, and about which pain may be localized. Tenesmus with evacuations *per anum* of blood-stained mucus is often present. Vomiting is not as frequently fæcal as in other varieties of obstruction. When blood is not discharged spontaneously it may appear after an enema. Constipation is not a very prominent feature. Sometimes digital examination of the rectum discovers a tumor.

In *internal strangulation* there is a history of a former attack of peritonitis by reason of which the constricting band was produced. The symptoms are sudden in onset and severe in character. The vomited matters become fæcal early, and constipation is absolute. A tumor cannot be discovered. Abdominal tenderness occurs only when peritonitis supervenes.

Volvulus is to be suspected when the sigmoid flexure is the seat of obstruction. The suspicion thus formed is strengthened by the history of long-standing constipation in a person tolerably advanced in years. Vomiting is a late symptom and is only exceptionally fæcal. Tympanites is marked, and abdominal tenderness appears early. The latter is experienced immediately over the twisted coil of intestine.

Obstruction by foreign bodies, calculi, etc., gives a history appropriate to such a condition. Then, too, before the body produces obstruction it causes more or less irritation, as exhibited by abdominal pain and discomfort. Physical examination sometimes discovers the presence of the offending substance; and sometimes it fails to do so.

In *fæcal impaction* the obstruction is of slow onset. Palpation and percussion reveal the presence of a large tumor in the parts about the sigmoid flexure and the rectum is found packed with hard fæcal masses. In some of these cases the irritation of the retained fæces sets up a local catarrhal inflammation and gives rise to a condition simulating diarrhœa.

When the obstruction occurs in the *duodenum* or the *jejunum*, collapse is early and profound, vomiting is one of the initial symptoms, the ejected matters containing bile, but never fæces. The abdomen is not distended and may even be retracted.

When in the *ileum* or the *cæcum*, vomiting is an early symptom and rapidly assumes a fæcal character. Flatulent distention is observed, particularly in the central portion of the abdomen.

When in the *colon* or *rectum*, tympanites is general; tenesmus may be either absent or present. Collapse does not appear so early, or the urine is not so likely to be suppressed as in occlusion of the small intestines.

The suggestion to judge the situation of an obstruction in the large intestine by the determination of the quantity of water which may be injected per rectum is of but little practical value. At the best the results obtained are uncertain. The same is true of the passage of flexible sounds. In intestinal obstruction, as in all other pathological conditions, there is no royal road to knowledge. Correct conclusions can only be reached by the adoption of all diagnostic aids and the careful analysis of the information thus obtained.

Prognosis.—Whatever the cause of the obstruction may be, intestinal occlusion must always be regarded as a very dangerous condition. Unaided by surgical treatment, the vast majority of cases tend rapidly and surely to a fatal issue. But notwithstanding this severe statement it is a well-known fact that there is not a variety of obstruction which may not make a spontaneous and complete recovery. The number of cases ending so fortunately is, however, exceedingly small. Intussusception is of all varieties the one most liable to spontaneous reduction. Death takes place at a period ranging from one day to two weeks, the higher the lesion in the intestinal canal, the more rapidly does the case tend to a fatal issue. Death results from shock, exhaustion, or peritonitis.

The accidents to which spontaneous recovery are due are at times remarkable. Thus the patency of the canal has been restored by the adhesion of two coils of intestine with a large perforation of their opposing surfaces. In other cases, *e. g.*, in intussusception, the receiving layer becomes gangrenous, sloughs and is passed *per anum*, the lumen of the intestinal canal being resorted. Stricture is very liable to follow these cases.

The prognosis of chronic obstruction depends upon the cause of the obstruction. If due to a malignant growth, nothing but surgical

interference is of any avail. When dependent upon impacted fæces, the prognosis is nearly always favorable.

Treatment.—The radical treatment of intestinal obstruction is mechanical relief through abdominal section. Inasmuch as some cases yield very nicely to non-surgical measures, it is permissible to resort to these first, hoping that operation may be averted. At the same time, the physician must bear in mind the uncertainty of the result, and the additional dangers which ill-advised delay may bring to his patient. Under no circumstances should purgatives be administered. Nothing is more illogical or more dangerous than the use of purgatives in this condition. Especially are they dangerous when localized or diffused tenderness shows the advent of inflammation. Even in cases of impacted fæces, other measures are more efficient.

Mechanical treatment looking to the reduction of the displacement can rarely be applied intelligently, because of the difficulty of determining the situation and character of the lesion. Certain measures have been recommended and may be tried, but in their practice one must bear in mind that he is working in the dark to a great extent, and that in his enthusiastic desire to do good, he must avoid doing harm. The most innocent measure, and fortunately also the one promising the best results, is washing out the stomach. This procedure in the first place gives great relief by lessening or stopping the vomiting, and in the second is occasionally followed by a reduction of the displacement. It lessens intra-intestinal pressure above the obstruction and diminishes violent peristalsis.

Another measure is the slow inflation of the intestines by large quantities of warm air or water. Jonathan Hutchinson recommends that this be done with the patient in the knee-chest position under an anæsthetic, and that the abdomen be thoroughly kneaded. This treatment is not without risk, for it has caused perforation of the bowels. Enemata when carefully given can empty the large intestine, and are most efficient when the obstruction involves that structure. Any influence exerted upon the small intestine can only occur by exciting reflex peristalsis, for it is only when the patient is under the influence of an anæsthetic that we can hope enemata to pass the ileo-cæcal valve. Sometimes an enema can relieve the gut above the obstruction, for while the mass above is too solid to pass downward, water can enter from below.

The administration of morphia is nearly always of signal service in relieving pain and reducing spasm, thus making the above-mentioned measures for the reduction of the displacement more efficient.

Altogether too little attention is paid to the nourishment of the patient. The obstinate vomiting makes the taking of food impossible. Rectal alimentation here comes in, and serves to maintain the strength of the patient, giving nature a longer time in which to bring about spontane-

ous reduction, or placing the patient under better conditions for operation. When rectal tenesmus is a prominent symptom, this method of alimentation is not practicable, indeed it is not needed, for in these cases the vomiting is rarely persistent. The administration of water by the bowel does considerable in the way of alleviating the great thirst which so often distresses the patient.

Electricity and massage are advocated by some and may be tried, but it must be remembered, with not too much energy.

The strictly medicinal treatment of intestinal obstruction must be conducted on symptomatic indications, certainly little can be hoped from remedies administered on a pathological basis only. Suggestions may be gained from the article on acute peritonitis.

Under any and all circumstances, attendant and family must be ready to resort to operation should the obstruction be not promptly relieved. Early operations give so much better results than do late ones, that it is wise for the physician to associate with himself a surgeon as soon as possible. Not only does he thus divide responsibility, but he has the additional advantage of another's judgment in determining the proper time for operation. He must remember that no hard and fast rules respecting the portent of individual symptoms can be formulated, and that experience is the guide which decides when to operate and when to delay.

APPENDICITIS.

The discovery of appendicitis or inflammation of the vermiform appendix as the origin of the inflammations of the right iliac fossa constitutes one of the great advances in modern medicine and surgery. In former years occasional autopsies on fatal cases of mysterious abdominal affections disclosed the appendix to be at fault, but the far-reaching importance of these observations remained unappreciated for many years. No better illustration of this statement exists than the following case quoted from Fagge, who was beyond question one of England's ablest clinicians. He says in his article on acute catarrhal gastritis, "I can never forget a case which I diagnosed as of this nature, and which proved to be one of acute suppurative peritonitis. A bank clerk felt poorly one day after having eaten some pears in the afternoon. In the night he woke up with epigastric pain and vomiting. A medical man was not sent for for two days, and when he came he gave a mild aperient. This operated, and a day or two later the sickness subsided. There was a little delirium about the third day. The pulse was at no period of the case over 100; the temperature ranged from 100° to 101°F. I was asked to see him on the sixth day. He then appeared to be better, the sickness and pain had ceased, he had begun to take food again. The pulse was of fair volume; the temperature exactly 100°. Except that the counte-

nance was sunken, and that the eyes were surrounded by deep, brown rings, there appeared no reason for alarm, and I concluded that the attack had been one of acute indigestion, and that the patient was in a fair way to recover. Within twenty-four hours, however, he died, and it turned out there was diffuse peritonitis set up by ulceration of the vermiform appendix." While many unrecognized cases thus proceeded to a fatal issue, there were many more that were regarded as enteritis, colic, or some mild abdominal disorder which improved under rest and careful dietetic precautions, and the true nature of which was never known until appendicitis came to be recognized as a clinical entity capable of ready recognition in the sick-room.

A variety of inflammatory affections occurring in the right iliac fossa has been described, including typhlitis, or inflammation of the cæcum, perityphlitis, or inflammation of the peritoneal covering of the cæcum, paratyphlitis or inflammation of the connective tissue surrounding the cæcum, and appendicitis, or inflammation of the appendix vermiformis. Clinical and pathological evidence seems to indicate that peri- and paratyphlitis certainly, and typhlitis probably, are but the results of appendicitis. The present tendency is, therefore, to recognize appendicitis as the only inflammatory disease occurring as a primary affection in this locality. There are some few cases, always of a mild character, to which we may apply the term typhlitis, but which after all may be the result of appendical disease. Typhlitis, so-called, occurs principally in young subjects, males far more frequently than in females. Excessive eating and constipation are important predisposing causes. Sometimes the attacks seem to have been brought on by the intervention of an exciting cause, such as exertion or exposure. The symptoms are rarely severe. They may be eithersudden or gradual in onset, and consist of pain in the right iliac fossa, digestive disturbances such as nausea, slight fever, and constipation. The patient lies on his back and exhibits a tendency to keep the right thigh flexed on the abdomen. Sometimes palpation reveals the presence of a doughy sausage-shaped tumor in the situation of the cæcum. The prognosis of these cases is entirely favorable. The pathological changes are therefore unknown, and their relation to appendical disturbances cannot be stated.

Etiology.—Age has an important bearing on the production of appendicitis, the majority of cases occurring in the young. Fitz's statistics give 50 per cent. of the cases as occurring before the twentieth year, and Einhorn's, 60 per cent. between the ages of sixteen and thirty years. Van Lennep makes the age of predilection prior to forty years, although no time of life is exempt, he having operated one patient at the age of seventy-five. This tendency on the part of the young to appendicitis receives an explanation from the investigations of Ribbert, who, studying the anatomy of the appendix vermiformis, proved that this structure

grew shorter and lessened in calibre with advancing years. Males exhibit a far greater predisposition than do females, the relative frequency in the two sexes being stated as from two to four to one. This predisposition is explained by Van Lennep from the fact that in the female the appendix derives an additional blood-supply through the appendiculo-ovarian ligament. This observation may account for the frequency with which the appendix is found in the female pelvis. It may be worth remembering that in every case he has seen in the female menstruation has begun soon after the onset of the attack. Sometimes appendicitis is secondary to other diseases. Thus it has been observed as one of the manifestations of tuberculosis; and Fitz has suggested that some of the cases of intestinal perforation occurring during the course of typhoid fever were really the result of appendical ulceration.

The exciting causes of appendicitis are twofold, the mechanical and the infective, and these may operate separately or in combination. The former include distention of the intestinal canal with fæces or flatus resulting in a dragging on the mesenteric folds of the appendix, torsion of its body, interference with its blood-supply, congestion, tumefaction, and inflammation; the entrance of foreign bodies or fæcal concretions into the appendix, there acting as sources of irritation; and injuries from muscular strains or blows. The infective cases are now believed to be due to the action of the bacterium coli commune. Some authorities claim that all cases are of this character, but the data in our possession do not make such a sweeping assertion tenable. The bacterium coli commune is always found in the healthy intestinal canal, and does not become pathogenic to man unless circumstances favorable to such action intervene. Many, White among the number, believe that mechanical causes first produce a pathological state in the appendix, and this, under favorable circumstances, may progress no farther; at the same time admitting that these lesions frequently become infected by the bacterium coli commune. Others, notably Einhorn, consider infection as the primary factor. They contend that the bacterium enters the appendix, and there finding a suitable soil for propagation, induces catarrh and subsequent thickening of the appendical mucous membrane, these lesions being further increased by the mechanical irritation of fæcal concretions and foreign bodies.

As to the mechanical causes of appendicitis, it was formerly believed that foreign bodies constituted a very important etiological factor of the disease. Statistical studies show the error of this, there being in no series of cases more than 12 per cent. of the cases due to this cause. Fæcal concretions are certainly of far greater importance, for they have been found present in about half of the cases. Constipation certainly has an important bearing in the production of the disease, a statement borne out by the observation that the victims of appendicitis usually give

a history of that symptom, and by the effect naturally ensuing upon habitual retention of fæces.

Pathology and Morbid Anatomy.—Appendicitis has been divided into the catarrhal and ulcerative varieties, a classification that has a practical bearing from both pathological and clinical standpoints. In catarrhal appendicitis the disease begins in the mucous membrane of the appendix and soon extends to the coats of that body. The entire tube is thickened and its peritoneal surface injected. Peritonitis develops and adhesions form between the appendix and contiguous structures. The mucous membrane becomes greatly thickened and the calibre of the appendix much lessened. Ordinarily in a relaxed state, the organ becomes firm and stiff. Fæcal concretions and foreign bodies may be found within.

The ulcerative variety, which is also infective, is characterized by ulceration which if not promptly checked progresses to perforation. If perchance the ulceration takes on an early reparative process, the resulting cicatrization may result in obliteration of the appendix. The results of perforation depend largely upon the structural conditions present at the time the accident takes place. If the organ happens to be hanging free and without adhesions, a general peritonitis at once ensues. As a rule, however, adhesions have formed, and these serve to limit the distribution of the succeeding peritoneal inflammation with the result of the formation of a circumscribed intra-peritoneal abscess. When the appendix is adherent to the cæcum, perforation into that body sometimes takes place. Then again the abscess thus formed often serves as a medium for further extension of the infective process, a general suppurative peritonitis resulting. The quantity of pus in the circumscribed abscess varies greatly in quantity. When small, the abscess may be surrounded by a large amount of inflammatory tissue. In other cases resolution takes place and the pus is absorbed. If the abscess ruptures, the consequences of the accident will depend upon the structures into which the pus escapes. When into the peritoneum, a most dangerous peritonitis follows; the pus may burrow beneath the fascia of the iliacus and appear below Poupart's ligament, perforating externally. Perforation into the pleura has been reported. Other rare points for the escape of pus are the bladder, portal vein, iliac artery, rectum, and the hip joint.

Symptomatology.—Like many other diseases appendicitis presents a variety of symptomatic pictures. That it may sometimes occur, even without suggestive symptoms, is evidenced by the fact that autopsies show the pre-existence of the disease in fully one-third of the subjects, in very many of which not the slightest suspicion of an appendicitis ever existed during life. One cannot judge by the symptoms, with any degree of certainty, as to the nature of an attack, *i. e.*, whether it is catarrhal or ulcerative. The most threatening symptoms sometimes attend the former,

and very mild phenomena the latter. Appendicitis is a disease of sudden onset. The first symptoms to assert themselves are localized colicky pain and tenderness. Other signs, such as nausea, vomiting, constipation and diarrhœa may be present, but are not necessary to the diagnosis. The pain usually appears suddenly. At first diffused, it is soon localized in the right iliac fossa. It is associated with tenderness, which is particularly well-marked at a point on a line drawn from the anterior superior spinous process of the ilium to the umbilicus, one-third of the distance from the first-mentioned point. It is aggravated by motion. The patient lies on the back with the right leg flexed on the abdomen. The pain is constant, but subject to paroxysmal exacerbations. Its features are sometimes modified by the nature of the tissues involved; when the connective tissue, it is usually dull; when the peritoneum, it is sharp and shooting. The paroxysmal exacerbation of the pain has been attributed by Deaver and others to expulsive efforts on the part of the appendix, an explanation objected to by Fowler, who claims that the muscular coat of the organ is too poorly developed to make such an action possible. With the pain we nearly always find rigidity of the abdominal walls, manifested particularly in the right rectus abdominalis, but extending to other muscles, even to those of the left side, with the advancement of the disease. Vomiting is by no means a frequent attendant. When existing in favorable cases it soon subsides; in the unfavorable ones it is apt to be a very persistent symptom. When the intestinal walls become paretic it assumes a stercoraceous character. In such cases septic peritonitis is usually present. As a rule, the bowels are constipated. Cases in which they act regularly or freely have been observed to do well. The temperature and pulse are both elevated, but such changes bear no definite relation to the character of the attack. In cases presenting from the very beginning a malignant type the fever has been known to be slight, while it has been found decided in cases of a purely catarrhal form. While the pulse is a more reliable guide to the severity of the disease, too much importance must not be attached to it. Abdominal distention is sometimes noted, and is due either to simple accumulation of gases or to paresis of the intestines. After the lapse of from two to four days a localized induration appears in the right iliac region in a certain number of cases. It may be either diffused or sharply circumscribed.

Van Lennep attaches importance to the aspect of the face and tongue. He says:

"The *facial expression* has been of great use to me, both in a diagnostic as well as a prognostic sense, and to the experienced eye it will often foretell impending disaster in obscure cases. In the beginning of an attack, the expression means little beyond distress, amounting to the hippocratic face in cases that are collapsed. It is when it indicates the pain of tenderness in the right iliac fossa, at the time of perforation or

when abscesses are forming, that it is of value. It is also an important guide in a beginning peritonitis, when we can recognize a suspicion of the facies abdominalis. I well remember the expression of a colleague whose hernia had come down and been but partially reduced, the omentum remaining. The bowels were moving regularly, and he felt perfectly well, beyond a little local tenderness and fluid effusion, which were attributed to the taxis. I had watched him for several days, when I noticed a beginning haggard look; then he told me of a peculiar burning at the roots of the pubic hair. Incision showed beginning gangrene of the omentum, which was excised and reduced in time.

"The *tongue* is almost always coated, flabby, and shows the marks of the teeth. This has become to me a symptom of considerable value, suggestive as well as corroborative. In its absence I would look for additional proof of the correctness of the diagnosis. One of the signs of improvement during the subsidence of an attack is the fact that it clears up and gets firmer."

Appendicitis may pursue a variety of courses. In the mildest, and, therefore, the most favorable cases, the inflammatory symptoms, viz., pain, tenderness, fever, and rapid pulse, gradually subside, followed by progressive recovery, which is generally complete in about two or three weeks. Other cases pursue a similar favorable course, but exhibit a most marked tendency to recur after any inordinate exertion, indiscretion of diet or lack of attention to the bowels. Such cases are called recurrent appendicitis. In still another class the pain and tenderness never entirely disappear, while from time to time certain causes operate to renew the activity of the inflammation. These are called relapsing appendicitis. Still others pursue an unfavorable course. They are attended by ulceration which results in perforation, or a septic peritonitis is set up and a fatal issue commonly follows.

Diagnosis.—The important diagnostic symptom of appendicitis is pain in the right iliac fossa with tenderness to pressure on the omphalo-spinous line one-third of the distance from the anterior superior spinous process of the ilium, *i. e.*, at "McBurney's point." While it is very generally admitted by surgeons that this point is usually a reliable guide, the variable situations which the appendix may assume lead to departures from its typical position, these being generally situated below rather than above the omphalo-spinous line. While the position of the appendix is often a matter of uncertainty, that of its point of entrance into the cæcum is not, for the latter body has a well-defined and constant location. Hence the base of the appendix is fixed, and serves to define the point of tenderness, if not exactly at McBurney's point, at one not very far removed from it. The presence of a tumor in the right iliac fossa cannot always be discerned even when inflammatory infiltration exists. Digital examination through the rectum often gives valuable informa-

mation especially if an anesthetic is employed. The latter also aids, by relaxing the abdominal walls, in the detection of a tumor by means of external palpation. Sometimes there is an ill-defined sense of fulness to the examining hand, or it is associated with œdema of the abdominal walls.

The diseases which may be confounded with appendicitis are typhlitis, perinephritic abscess, intestinal obstruction, the different varieties of colic, entero-colitis, neuralgia, rupture of an extra-uterine pregnancy, and abscess of the abdominal wall. In typhlitis the symptoms are always of a mild type, tenderness is not great, and a doughy mass in the right iliac fossa is discoverable. The symptoms are promptly relieved when a thorough evacuation of the bowels has been secured.

Perinephritic abscess is distinguished by the absence of intestinal symptoms, and by the previous history of the case.

Intestinal obstruction is characterized by the very sudden onset of the symptoms and the concentration of pain in the umbilical region. Constipation is complete, even flatus being retained. Fæcal vomiting is a prominent feature. Fever does not assert itself until the advent of peritonitis. In the case of intussusception, stools consisting of bloody mucus and associated with tenesmus are noted. The advent of intestinal obstruction is often marked by shock and even collapse, features rarely present in the early stage of appendicitis.

In gall-stone colic the first attack of pain, as in appendicitis, may be diffused over the abdomen, but is soon localized in the vicinity of the gall-bladder, and is often reflected to the right shoulder. Symptoms suggestive of hepatic disturbance are often present. In renal colic the pain courses along the ureters from the kidneys to the bladder. Sometimes it is diffused over the abdomen and is apt to be associated with retraction of the testicle and tenesmus vesicæ. Entero-colitis has a diffused abdominal pain with diarrhœa.

Neuralgia of the right iliac fossa may present some similarity to an attack of appendicitis; but inflammatory symptoms such as fever and tenderness are wanting. Pressure generally brings relief, or at least does not aggravate the pain.

Several cases of ruptured extra-uterine pregnancy have been diagnosticated as appendicitis. The history of a pregnancy and the physical examination will protect from error in most instances.

Abdominal wall abscess will not give rise to error if the local signs are correctly observed.

Prognosis.—Notwithstanding the fact that about 80 per cent. of all cases of appendicitis end in recovery without operation, the disease must be regarded as a highly dangerous one, for no matter how mild the symptoms may be, or how apparently trivial the illness, the case may suddenly assume a most malignant type, passing beyond the control

of the most expert treatment. Unfortunately too, we are not in possession of any positive data by which we can certainly recognize the dangerous cases in the early stage, when it is of the highest importance that such recognition should take place. Were it possible to diagnosticate the pathological changes present in any given case, there would be no difficulty in framing a prognosis and defining a treatment. But this we cannot do. Prompt surgical interference gives very favorable results. Some operators have gone to the extent of saying that the dangers of the operation are practically *nil.* This may be true in the hands of finished operators of large experience, but it does not apply to the average surgeon whose experience in these cases is necessarily limited.

Cases in which the associated peritonitis is localized and the suppuration circumscribed offer a favorable prognosis under proper treatment. When the peritonitis is diffuse and suppuration general, a favorable result is scarcely possible. Abscesses rupturing into the bowel recover as a rule. The prognosis is still more favorable when the opening is through the abdominal walls. Early operations by competent surgeons almost invariably result in recovery. Cases operated during the quiescent period scarcely ever result fatally.

Quoting Van Lennep once more:

"Given an acute, honest attack of appendicitis, and the symptoms should subside, as in one of indigestion, in a few hours, six, eight, ten or twelve, or after the bowels have been moved. In other words, such a case within this time should tell us unmistakably that it is getting well. Should the symptoms persist or increase during this time, or, to be *very* conservative, for twenty-four hours, in general the danger of an operation is much less than that of waiting. Again, at any of these named hours, if the symptoms, and, particularly, the pain or local tenderness, become worse, or even remain stationary, after beginning to subside, the danger of waiting overwhelmingly outweighs that of surgical interference. Lastly, if at any time during the one, two, or three weeks of convalescence, or even after recovery, tenderness at the pathognomonic point recur or get worse, it is better to cut than to wait.

"On the other hand, the subacute, dishonest attacks are to be feared, because they are not recognized and because they are so treacherous in their results. The same indications must be our guide: persistent or increased tenderness, before or after subsidence, and the signs of abscess formation or peritoneal infection.

"I am convinced that the one-week, then five-day and then forty-eight-hour time-limit must be further reduced to twenty-four hours *or less.* The diagnosis, and even the prognosis, must be settled long before this and operation either decided on or done at or before this time.

"Some 70 or 80 per cent. of attacks get well without operation, and the vast majority of them indicate that they are going to do so in much less than twenty-four hours.

"Some 10 or 15 per cent. save themselves in spite of us, that is, nature shuts off the leaks, and we have encysted abscesses which evacuate themselves alone or by aid of the scalpel. They all show their danger signals within this time.

"Some 10 or 15 per cent. more would die but for surgical aid, given in answer to this warning. The fact that this warning is not heeded in time causes the mortality of appendicitis."

Treatment.—In the management of a case of appendicitis the first question to arise is that of the advisability of operation since, notwithstanding the very large percentage of recoveries under medicinal treatment, any case however mild may at any time present strong indications for immediate resort to the surgeon's knife. My personal views upon the operative treatment of appendicitis have recently undergone considerable change as the result of careful investigation of the subject, having had the opportunity of observing an unusually large number of operated and unoperated cases during the past year. There can be no doubt but that we physicians have been occupying too conservative a position, respecting operative interference in these cases, based upon supposed results in its treatment. The error we have made has been in forming our opinions upon diagnosticated cases only, of which nearly all have recovered, and overlooking those cases appearing as peritonitis, etc., which we are now only learning were excited by a primary appendicitis. It is this 5 per cent., or thereabouts, which heretofore were not known to be dependent upon appendical disease that proper surgical measures will save if employed sufficiently early. In many such the indications arise so suddenly and so unexpectedly that there is scarcely time to act. It is, therefore, a question well worthy of calm consideration, whether or not it is wise to order an operation during the quiescent period, *i.e.*, early in the attack before dangerous symptoms appear. In this as in other surgical precedures the general state of health helps to a decision. The state of the kidneys, the presence or absence of arterial degeneration, the general condition of nutrition, and the previous habits of the patient, must all be considered. The fact that experienced operators secure 100 per cent. of recoveries from early operations must not lead to indiscriminate surgery, for the inexperienced cannot expect to be so fortunate.

In awaiting a decision as to operation our vigilance cannot be too great. Indeed it is the part of wisdom on the part of the attendant to at once associate with himself a surgeon, that the progress of the case may be more closely watched. If, at the end of twenty-four or forty-eight hours, there has been no abatement of the symptoms, and the pain especially is no better, an operation is generally called for. Increased tenderness and tympany make the demand for operation imperative. An expectant plan may be followed with more peace of mind when the bowels are acting regularly and vomiting is absent or slight, when the

pain is dull and the point of greatest pain is not exactly at the McBurney point.

The selection of a time for operation is always a matter of importance. If the indications are for subsidence of the present attack and yet the operation seems to be inevitable, it is wise to wait until the quiescent period. Recurrent cases as a rule demand operation sooner or later, especially when the attacks have been repeated frequently and are separated by shortening intervals. Relapsing cases should invariably be operated. The fact that purulent accumulations are sometimes absorbed and the patient is none the worse thereby, should weigh little, excepting in the presence of greater dangers, as old age and organic visceral disease, for a patient with intra-abdominal abscess, is in constant danger.

In pursuing the medicinal treatment pain constitutes a prominent symptom demanding relief. It is very rarely, if ever, that the physician should resort to such palliative measures as the administration of opium or morphia. In the first place these drugs mask symptoms and so prevent accurate observation of the course of the disease, pain and localized tenderness being our best guides; and, in the second place, opium preparations tend to paralysis of the bowels, a complication altogether too common in appendicitis without being made more prominent by unwise medication. The thorough evacuation of the bowels is, on the other hand, generally good practice. It brings about a condition of internal cleanliness, lessening chances of infection, and in cases in which the cæcum bears the brunt of the inflammation, may be followed by rapid relief. The best means for this purpose is the administration of an enema consisting of a half pint of water, to which has been added one tablespoonful of turpentine.

The early application of the ice bag to the right iliac region is good practice.

Belladonna proves the most useful remedy for the majority of cases in the early stage. It is especially valuable for young vascular subjects, who are considerably flushed and complain quite bitterly of the pain, which is rapid in onset and much increased by motion, even by jarring of the bed. The patient lies upon the back with the thigh flexed upon the abdomen. Tenderness is marked. The first decimal dilution should be repeated hourly. I have observed good results from *aconite* in a few cases, during the very early stage, the medicine being prescribed upon its general and oft-quoted symptoms. *Bryonia* is applicable to some cases in the early period, but its especial indication is the sharp, stitching pain, aggravated by every movement, and which indicates the development of peritonitis. In the majority of these cases, however, bryonia must usually be soon discontinued, as it is not well suited to the septic form of peritonitis which is so common in connection with appendicitis. *Rhus toxicodendron* is indicated by associated rather than

by local symptoms. In the early stage it is suggested by aching in the limbs and back and by restlessness, which causes the patient to shift his position frequently in spite of the local pain. There is also an irritable looking tongue, especially at the tip and edges. In later stages of the disease it is the group of symptoms called "typhoid" which calls for its administration. *Lachesis* has repeatedly given me prompt results when extreme sensitiveness to touch constituted the prominent symptom, even the weight of light covering was complained of. If there is an aggravation of symptoms on awaking from sleep and in the middle of the afternoon, and a slight delirium, the indications for its use are much strengthened. *Mercurius* may be given when there is a marked tumor, with evidence of suppuration and considerable warm sweat. This remedy may be changed for *hepar sulphur* if the symptoms of suppuration continue to increase in spite of the former remedy. In the late stages of suppurative cases *silicea* and *sulphur* may be of some service in association with proper surgical care. *Mercurius corrosivus* is the most useful remedy for the peritonitis, although it must be carefully compared with *arsenicum* and *cantharis*.

For completeness it may be stated that *arsenic*, *ginseng*, *colocynth*, *colchicum*, *lycopodium*, *kali carb.*, *thuja*, *plumbum* and *veratrum album* are all recommended by different observers.

CONSTIPATION.

The importance of constipation as a symptom has been as greatly underestimated, by some physicians, as its evils have been exaggerated by others. One school taking an extreme view of the subject teaches by its therapeutic methods that nearly all the ills which flesh is heir to proceed from inactive bowels, for they direct nearly their entire medication to the increase of intestinal peristalsis. At the other extreme we find those who ignore constipation entirely, for they rarely if ever seek to give the patient relief by laxative medication, or even endeavor to bring about regularity of bowel action by the enforcement of hygienic rules. As in all cases where extreme and diverse views are entertained, the truth is represented by a midway position. Constipation is a sympton which sometimes demands relief; it frequently causes considerable inconvenience, if not actual suffering; in some cases it is but a secondary condition, arising from complaints to which the treatment should be directed; in others, it is the primary ailment, the correction of which restores the body to health.

Definition.—Constipation is ordinarily defined as a condition in which fæcal matters are retained within the bowels an abnormally long time. This does not, however, give an adequate idea of the symptom. Taking as a standard the majority of people there should be one daily evacuation, the stools being cylindrical in shape and tolerably firm.

But there are persons who are accustomed to two stools daily, and others who do not have an evacuation oftener than once in two or three days. In both of these departures from the usual, no evil influence seems to have been exerted on the general health. Then again, we meet with another class of people accustomed to great regularity of the bowels, the slightest departure from which is followed by a train of symptoms causing considerable discomfort. In defining the term constipation, therefore, it is necessary at the outset to determine what constitutes the normal standard for the particular individual whose case is under examination. At the same time it is important not to regard a morbid state which has become habitual with the individual through years of ill-health as a normal one.

Etiology.—Among the important causes of constipation as a primary condition stands habit. The bowels readily become accustomed to emptying themselves at regular periods. Many persons, and women in particular, neglect this fact, going to the closet only at such times as suits their convenience; thus irregularity is fostered and this irregularity develops into habitual constipation. The inclination which drives a patient to stool is the result of a physiological reflex, which is, however, to a great extent, under the influence of the will. The person who regularly resists the calls of nature interrupts the normal reflex, the mucous membrane of the rectum becomes finally accustomed to the presence of retained fæces, its sensibility is dulled, and the normal reflexes of the part are destroyed. Persistent retention of fæcal masses within the rectum causes dilatation of that organ, which, in turn, lessens the expulsive power of its muscular coat.

A sedentary life and its attendant evils, imperfect digestion, bad ventilation, faulty attitudes while at work, and the nerve-wear incidental to mental labor, are the cause of many cases of constipation.

Age is always an important factor. Although elderly people are more regular in their habits, they are at a time of life when degenerative changes occur, the rectal mucous membrane loses much of its wonted sensibility and peristaltic action is less vigorous. There is also apt to be more or less of muscular degeneration. The constipation of infants is often the result of a milk supply too rich in casein.

Women are very prone to constipation, but largely so because the faulty habits to which reference has already been made, are very common among them. Through a false sense of modesty they are sometimes apt to neglect regular attempts. Diseases of the generative organs increase the tendency to constipation. In many instances, however, the reverse condition obtains, the acquired constipation leading to congestion of the pelvic viscera, and if long continued, to very obstinate disease therein.

Heredity appears to exercise some influence.

The diseases in which constipation appears as a symptom are legion.

In all the acute febrile diseases the lessening of intestinal secretion and the absorption of the liquid contents of the bowels account for this symptom. For the same reason constipation is an important feature of diabetes, and is observed during hot weather in persons who perspire freely. Numerous chronic diseases affecting the heart, lungs, liver, kidneys, and blood, give rise to inactive bowels because of their ability to produce muscular degeneration. In brain diseases constipation is more frequently present than absent, appearing in some instances to be due to loss of peristaltic power; in others to spasm of the muscular coat of the intestines.

Excessive drugging is a very common cause, especially among the hypochondriacal and the ignorant. No matter how effectually a cathartic or a purgative may act when first administered, the time is not far distant, when it will lose its power. It seems that the overstimulation produced by this class of drugs leads to exhaustion of the muscular and other activities of the intestines. The more the patient indulges in this kind of medication, the more serious are the results arising therefrom.

Some patients are constipated because of faulty diet. Sometimes they do not eat enough to give a sufficient residue to require daily bowel movements. In other cases, the character of the food is such that it leaves but little waste, beef and milk being of this class. Constipation naturally results. Then again food of the opposite character may fill up the bowel to such an extent as to make its removal a matter of some difficulty. Under such circumstances local irritation and intestinal catarrh are produced.

Various gross intestinal lesions are sometimes accompanied by constipation; of these tumor is a prominent one. Atony of the bowel is a frequently assigned cause. It is doubtful, however, if the latter should be dignified as a special morbid entity, for in the majority of cases in which it is present it constitutes but one of the morbid conditions entering into the symptom group of a general neurasthenia. Quite a variety of painful affections about the anus and rectum may inhibit bowel movements because of the pain occasioned by them during stool. Maladies belonging to this class are hæmorrhoids, fissure and local eczema.

It is possible that the intestines of some persons have an illy-developed muscular coat, which would account for a life-long constipation.

How far anæmia or chlorosis can be a cause of constipation is conjectural. The majority of chlorotic girls are constipated. Sir Andrew Clark believed that in very many instances the intestinal sluggishness was responsible for the blood deterioration. The retained fæcal masses, in his opinion, were partially absorbed with a resulting auto-intoxication. This theory is entitled to considerable respect, as there can be no doubt of its partial applicability. Recent old school authorities have taught that iron does but little good in chlorosis until the patient has been purged.

Intestinal action is occasionally hampered by mechanical obstruction, such as that occasioned by cicatricial bands, peritoneal adhesions, etc.

The intestinal atony is not infrequently associated with a similar state of the abdominal walls.

Symptoms.—The ordinary symptoms arising from simple constipation consist of debility, headache, vertigo, foul taste in the mouth, a coated tongue and a sense of fulness in the rectum. These subside rapidly as soon as regular evacuations have been secured. On the other hand, cases occur in which none of these inconveniences are experienced.

The headache is rarely of severe character. It is often attended by a feeling of heat and fulness, and is characterized by morning exacerbations.

Abdominal symptoms are present in many cases, and consist of slight griping or clawing pains, due to intestinal peristalsis excited by the irritation of the retained and hardened fæcal masses. These are sometimes associated with rumbling of flatus. The stools themselves are usually hard and shaped like balls. Very often they are coated with mucus.

The presence of hardened fæces in the rectum is very apt to excite quite a variety of symptoms by reason of the pressure exerted on contiguous structures. In women, ovarian and uterine congestion is not uncommon and men may suffer from seminal emissions. Painful affections and circulatory disturbances of the lower extremities appear in some. Hæmorrhoids develop in the majority of obstinate cases, and by the pain they cause intensify the original trouble.

The symptoms arising from fæcal absorption are referred mostly to the nervous system, and consist mainly of disturbed sleep, debility, general nervousness, vertigo, muscæ volitantes, chilliness and palpitation. Mental depression is a very common phenomenon, in some cases indeed, constituting the sole trouble for which the patient seeks relief.

Prognosis.—As a rule the prognosis of chronic constipation is favorable. Great difficulty is often encountered in forcing the patient to obey instructions implicitly, which is the especial reason why so many remain uncured. Much, of course, depends upon the character of any primary disorder which may exist. Temporary constipation of but a few days duration usually recovers spontaneously or from simple treatment and need occasion no concern.

Treatment.—The remarks made concerning the causes of constipation suggest the measures to be adopted for the cure of this condition. At the very outset the patient must be taught regular habits. It should be a rule of life to go to stool at a definite hour each day, and that irrespective of any inclination for the act. On the other hand, long-continued and ineffectual urging is to be condemned. The best time is

immediately after breakfast, as intestinal peristalsis has already been excited to a certain extent by that meal.

An inclination to stool may be often coaxed if the mind is directed to that act for some time prior to the attempt.

Should the stools be dry and hard, the constipation may often be greatly alleviated if not entirely prevented by the drinking of a full glass of water on retiring and again on rising in the morning.

Persons of sedentary habit must indulge in regular exercise, preferably out of doors. Horse-back or bicycle riding, walking, tennis and outdoor sports generally, are to be recommended.

General cold tonic sponge baths, taken the first thing on rising in the morning, will tend to lessen a neurasthenic condition and to a great extent alleviate the condition of the bowels.

Many cases are greatly benefited by abdominal or general massage. The expense attendant upon this treatment will deter many from adopting it. A fair substitute is the rolling of a five-pound cannon ball over the abdomen for ten to twenty minutes twice daily, preferably in the early morning, and late in the evening.

When the abdominal walls are flaccid and the intestines atonic, a moderately firm bandage will do much good, but far better are exercises of the abdominal muscles. These are carried out by retracting the abdominal walls forcibly, rapidly, and repeatedly, several times daily.

The diet constitutes a matter of great importance. The food must be such as leaves considerable residue, so as to excite peristalsis by its mechanical action. It must also be of a character to be easily digested. Fresh vegetables and fruits, stewed fruits of various kinds, and baked apples are especially good. While ordering a diet consisting very largely of these articles, care must be taken not to avoid tissue-forming substances, as milk, beef, eggs, etc. Graham bread and brown bread stimulate peristalsis better than bread made from the ordinary flour. A cup of coffee without sugar or cream taken before breakfast is with many a very efficient excitant of stool after breakfast. While the use of tobacco in excess undoubtedly tends to a constipated habit, it is equally true that there are some persons of costive habit who receive great relief from a short smoke after breakfast.

Some cases of constipation in neurotic subjects depending upon intestinal atony find their remedy in measures directed to the neurasthenic state. While the patient is at home and pursuing his ordinary occupations, subjected to all the wear and tear of an active life, his trouble continues; but as soon as he gets away for recreation, bowel action becomes normal. Such cases find relief from all invigorating measures, such as surf-bathing, exercise, fishing, hunting, etc.

Constipation of a few days' duration in persons previously healthy, should, as a rule, be ignored. The normal condition will return very

shortly without resort to active measures of any kind. If the retention of fæces causes discomfort, and is in danger of bringing on hæmorrhoids and other troubles, the bowels should be relieved by a very free injection of water in which a small quantity of castile soap has been dissolved, or water containing salt in the proportion of one tablespoonful to the quart. This means is particularly applicable when the fæcal masses are hardened. These enemata are furthermore of value in obstinate cases in aiding to bring about a regular habit, by administering them at stated regular intervals in order to accustom the bowels to act at such times. They must always be used with caution, however, as they may bring about intestinal atony by the repeated distention of the bowels. When possible it is better to inject a few ounces only of water containing strong soap, and allow it to be retained for a half hour.

Glycerin enemata are also valuable measures for exciting stool. The injection of one drachm of pure glycerin usually creates active peristalsis and transudation of fluid, and a stool follows from two to five minutes after the administration. Glycerin suppositories are also good, though not as active as the pure glycerin.

In mild cases of constipation, especially in children, gluten suppositories are very efficient. In infants a favorite home remedy is the insertion of the well-oiled finger or a piece of castile soap into the anus, which usually brings about a prompt evacuation.

When fæces are well-impacted owing to neglect of the ordinary precautions during the course of acute ailments, we find that the full water enemata has an efficient ally in an injection of eight ounces of olive or cod-liver oil into the rectum. In such cases the small injection should precede the large one by a half hour, which will result in softening the mass which it is desired to dislodge.

The use of violent purgatives or cathartics is, as a rule, to be condemned. They find their place only when, for one reason or another, it is important that the bowels should be thoroughly emptied, the condition being a temporary one, or the indications calling for but a single purging. Frequently repeated they do more harm than good. The free movements which they excite are succeeded by a higher degree of constipation. The bowels furthermore soon become accustomed to them, so that they either cease to act at all, or their habitual administration in increasing doses becomes a positive necessity.

When for some reason it is unwise to introduce cathartic remedies into the stomach, a free evacuation may be excited by the following prescription: Sulphate of magnesia, two ounces; glycerin, two fluid ounces; turpentine, one-half fluid ounce; and boiling water four fluid ounces. The entire quantity is to be injected into the rectum. It brings about a very free movement within a short time. This prescription is highly valued by abdominal surgeons as a means of empty-

ing the bowels prior to operation. In patients with arterio-sclerosis, and high vascular tension, it will reduce the latter quite materially and relieve the distressing symptoms arising therefrom.

In cases of persistent retention of fæces, it may be necessary at the outset of a rational course of treatment to completely empty the bowels by using a purge. To do so, however, without full and sometimes repeated enemas is pretty apt to excite considerable distress besides endangering the success of the remedy, as the active peristalsis induced is expended on hardened and impacted fæcal masses.

Useful laxatives for use under such circumstances are *cascara sagrada* or some natural spring water such as Hunyadi or Carlsbad. The cascara is best administered in the form of the dry extract, from one- to three- or five-grain tablets three times daily, the last-mentioned dose rarely being necessary. The waters should be employed in doses of two to six ounces combined with an equal quantity of boiling water, as they are more active when hot and also in large bulk. While advising these remedies as last resources, it is well to bear in mind that very many cases in which their use seemed inevitable have recovered promptly as soon as the patient put into active operation the measures already advised regarding habits, exercise and diet.

Electricity is of value in some cases. Either galvanism or faradism may be employed. If the latter, an uninsulated rectal electrode is attached to the negative pole and inserted into the rectum, while the positive pole (a large, flat electrode) is applied to the abdomen. A moderately strong current (not sufficient to excite discomfort) is then made to pass for fifteen minutes. In the case of galvanism certain precautions are to be adopted. The rectal electrode is to be an insulated one. It should also be hollow so that from four to eight ounces of water may be injected through it into the rectum. The best electrode for the purpose is that devised by King, of New York, and manufactured by Waite & Bartlett, of that city. The electrode introduced and the water injected, the rest of the procedure is conducted as in faradic applications. The strength of current should be from fifteen to twenty milliamperes, and the séances should be repeated daily or every other day.

Of remedies for the cure of constipation *nux vomica* and its alkaloid *strychnia* deservedly rank as the first. The latter is useful in atonic cases in the second decimal trituration, one tablet of which should be administered three or four times daily. Nux vomica finds its special indication in ineffectual, fitful, urging to stool, especially in persons who have been addicted to the use of purgative remedies. The nux symptoms, headache, nausea, and foul taste in the mouth in the mornings, are usually present, also hæmorrhoids. *Sulphur* is a remedy held in high esteem in the treatment of chronic constipation.

Hughes believes that the treatment of the majority of cases of this

trouble may be advantageously begun with this remedy, although he does not counsel its continuance longer than the first week. The constipation alternates with diarrhœa in the cases in which sulphur is characteristically indicated. In many instances the alternation of this remedy with the one just mentioned is fraught with good results, each medicine seeming to fortify the action of the other. Some years since Sir Andrew Clark called attention to the value of sulphur in chronic constipation associated with portal hyperæmia. In doses of three to five grains on rising in the morning it usually gives quite a normal movement. It may be continued for some time without unpleasant results. *Hydrastis* is greatly underestimated as a remedy for habitual constipation. It is especially useful in those cases in which the stools are hard and coated with mucus. Like nux vomica it is adapted to cases aggravated by repeated purgation. Gastric and hepatic symptoms are nearly always present. There is a weak sinking feeling in the epigastrium, frontal headache, sour eructations and hæmorrhoids. It is best administered in the fluid extract, one drop three or four times daily. *Bryonia* is suited to cases of constipation due to failure of the intestinal secretions. Hence the fæces are hard and dry. There is no urging to stool. The patient is apt to be irritable or hypochondriacal. *Opium* is indicated in cases presenting clinical features similar to those calling for bryonia; the stools are dry and hard. The trouble, however, is due to inactivity of the entire intestinal tract and not so much to insufficient secretion. It is one of the remedies for the intestinal torpor following acute diseases. In the constipation attendant upon lead colic it is invaluable. In these cases material doses are sometimes required. Opium is often serviceable for the constipation of old people. I have several times observed relief from a chronic constipation while giving small doses of morphine for pain, cough, etc., and subsequent observations have shown that these larger doses sometimes succeed after small ones have failed. *Plumbum* is applicable to cases in which there is spasm of the sphincter ani and of the muscular coat of the bowel. There are associated griping pains and retraction of the abdominal walls. *Collinsonia* has gained considerable reputation as a valuable remedy in constipation associated with or dependent upon hæmorrhoids. The pains attending the latter are of a sharp sticking character. There is more or less bleeding. *Sepia* for constipation of women with pelvic troubles, "sensation of a lump having lodged in the rectum." Numerous remedies other than those mentioned are useful, but they are indicated by associated conditions, and not by the character of the constipation *per se*. Hence their mention at this time is superfluous.

RECTAL ALIMENTATION.

When referring to the general treatment of quite a variety of diseases in other portions of this work, the author has had occasion to recommend rectal alimentation either as an advisable or a necessary means of maintaining the patient's general nutrition. Notwithstanding the great value of this method of feeding, it does not seem to have received the attention, or been resorted to as frequently, as facts warrant. The procedure is exceedingly simple and requires only ordinary care on the part of the attendants. The subject is by no means a new one, nutrient enemata having been administered by an Italian physician in 1691, life being sustained in this instance by rectal feeding alone for sixty-six days. This case, as well as many others since that time, has proven conclusively the possibility of maintaining nutrition by rectal alimentation, so that in a practical work like the present, it is unnecessary to enter into any discussion as to the modus operandi by which the nutriment is digested or absorbed.

Indications for Rectal Alimentation.—Rectal alimentation is indicated in all cases in which the pharynx, œsophagus, and stomach are so extensively diseased as to require absolute rest, in cases of œsophageal stenosis and paralysis of deglutition, and in severe and intractable vomiting.

Character of the Nutriment to be Used.—Almost any easily digested food may be employed in a liquid form for administration by the rectum. Complicated formulæ are entirely unnecessary. In ordinary cases I am in favor of plain or peptonized milk, to which a small quantity of salt (one-third of a teaspoonful) and a raw egg have been added. In other cases liquid peptonoids may be given with an equal quantity of milk, or better, whey, or solutions of predigested meat extracts, so extensively manufactured all over the country, may be employed. These, of course, do not have a very high food-value, and are hardly sufficient for the preservation of nutrition for any great length of time. It may then be necessary to use some such preparation as Leube's pancreatic-meat emulsion, which is so highly praised by Dr. J. Nicholas Mitchell, he having prescribed it extensively in the malignant vomiting of pregnancy. It is prepared as follows: "Take about five ounces of finely scraped meat, chop it still finer, add to it one and a-half ounces of finely chopped pancreas free from fat, then add about three ounces of lukewarm water, and stir to the consistence of a thick pulp; this is given at one time, care having been taken to wash out the rectum with water about an hour before."

Precautions to be Observed.—Notwithstanding the simplicity of rectal alimentation, carelessness in technique may lead to utter failure. The rectum is a delicate organ and may be made intolerant by rough usage.

The tube used should be a soft rubber one of large calibre. The rectum must be thoroughly washed every day by a copious enema of salt solution in the proportion of one tablespoonful to the quart of water. It is important that the patient should remain at absolute rest for half an hour before and after the administration of the nutrient enema. The quantity administered should never exceed six fluid ounces; ordinarily, four fluid ounces are sufficient. About three enemata daily will be required by most cases.

AFFECTIONS OF THE PERITONEUM.

PERITONITIS.

Definition.—Inflammation of the peritoneum.

Varieties.—Inflammation of the peritoneum as of other serous membranes presents a variety of pathological types, which, however, cannot be sufficiently differentiated in practice to make such a classification useful in clinical work. Acute and chronic peritonitis are recognized. According to the character of the exudation, we have exudative, adhesive and purulent peritonitis. The latter cases are also spoken of as acute septic or suppurative peritonitis; the significance of these designations will appear shortly in describing the disease. According as the inflammation is limited or diffuse, we have circumscribed and diffuse peritonitis.

Etiology.—The first question involved in the study of the etiology of peritonitis is as to the possibility of the disease ever occurring as a primary disorder. Inflammations of other serous membranes are claimed to thus arise, and the question of the possibility of the same being true of the peritoneum appears quite pertinent. In former years acute idiopathic peritonitis was regarded as a rather common affection, but this view has grown less and less frequent with the advances in pathological knowledge of the abdominal viscera and of the peritoneum. The majority of authorities now look upon this type of the disease as a myth. Others, among whom is Senn, believe that it may occur occasionally. These primary cases are generally attributed to the influence of cold, and hence are sometimes spoken of as rheumatic. Another alleged cause is injudicious diet. Cases also occur in which the most acute clinical and pathological observer fails to discern any cause. These must for the present be regarded as examples of primary or idiopathic peritonitis, although there is every prospect that advancing knowledge will teach us facts which will relegate them to the category of the secondary disorders.

The circumstances under which peritonitis may appear as a secondary disease are quite varied. There is hardly an affection of any of the abdominal viscera which may not be its starting point. In the vast majority of instances, however, the gastro-intestinal tract or the pelvic viscera are at fault. Of the causes originating in the former, appendicitis is pre-eminently the one most frequently observed; although cases follow

perforation of intestinal and gastric ulcers, malignant tumors of the stomach or bowels, acute toxic gastritis, acute intestinal obstruction, and strangulated hernia.

Pyogenic diseases of the pelvic viscera constitute the common cause of peritonitis among women. A very large proportion of these cases arise from puerperal infection. Others result from gonorrhœal infection or from suppurative disease of the uterus, tubes, or ovaries. Peritonitis also results from the irritation excited by ovarian tumors, or from their rupture, and from various uterine growths.

Traumatism is a very common cause of peritonitis. While the majority of cases arising from this agency succeed operation and penetrating wounds of the abdomen, others are produced by blows of various kinds which do not affect the integrity of the external integuments or of the abdominal viscera.

Pathology and Morbid Anatomy.—Elaborate studies relating to the pathology of peritonitis have caused quite a revulsion of opinion relating to this subject. As already stated, peritonitis is divided into various types, according to the character of the exudate, some of which are regarded as of simple inflammatory origin, and others, as of a septic nature. Recent studies tend to place all cases, however mild, in the latter class. Considering the morbid changes present, one is forcibly impressed with the fact that the inflammatory appearances bear no definite relation to the severity of the symptoms, suggesting the conclusion that the danger incurred is not due to the inflammation, but to the absorption of some subtle poison, the exact nature of which is as yet unknown. Indeed it would seem that the most marked inflammatory changes are observed in the mildest cases. Treves even takes the ground that the inflammation is a conservative process, which lessens the dangers of systemic infection.

The first change observed at the autopsy is distention of the intestinal tract. The peritoneum is found more or less injected, decidedly more so in some spots than in others. It is apt to be especially marked near the situation at which the inflammation starts. When the process is a severe one, hæmorrhagic exudations are observed in spots. As is the case in other serous membrane inflammations, there is a fibrinous exudate, which covers the peritoneum to a greater or less extent, forming thereon a false membrane manifested as a thin, grayish-yellow covering, easily removed by scraping with the back of the knife. This fibrinous exudate may be associated with considerable outpouring of serum, which gravitates to the most dependent portions of the peritoneal cavity. When the quantity of serum is limited, there is a marked tendency to the formation of adhesions between opposing peritoneal surfaces. In the later stages of the disease, or in cases which recover, the adhesions undergo connective tissue transformation, producing by reason of the

stretching incident to the frequent intestinal movements, fibrous bands of different shapes and sizes. In some cases the adhesions are so extensive as to bind all the abdominal viscera together in a confused mass, and are so firm as to make their separation well nigh impossible. Sometimes the adhesions are so distributed as to imprison the exudate within a circumscribed area and give rise to cyst-like formations.

Departures from the characteristic sero-fibrinous exudate are frequently observed. In certain cases, especially those arising from scurvy or cancer, there is an outpouring of blood; the fluid assumes a red color, and the microscope detects the presence of red blood-corpuscles. Very often in the sero-fibrinous cases numerous white flakes of lymph are discernible. The quantity of inflammatory effusion varies greatly, not amounting ordinarily to more than a few ounces. It may reach several pints. Purulent accumulations are also found in great variety. When large in quantity, they are generally of liquid consistence; when small, thick. Sometimes the purulent exudate is strictly localized, and is referred to as an abscess. Long continuance of circumscribed suppuration leads to ulceration of the adjacent peritoneal surfaces, and to perforations with resulting formation of long fistulous tracts, discharging externally or into one of the hollow viscera.

The prevailing view that all cases of peritonitis are of septic origin seems to have a good foundation. No specific micro-organism has been alleged as the cause of the disease. Indeed, investigations teach that it may arise from quite a variety of infections. The majority of cases seem to find their origin in infection from the bacterium coli commune. Still others are undoubtedly produced by the staphylococcus pyogenes aureus, the staphylococcus albus and the staphylococcus pyocyaneus, as well as by other micro-organisms. There is also evidence to show that in some cases the inflammation is the result of the action of the products of microscopic growth and not to the latter themselves. The bacterium coli commune, as is well known, is found in great numbers throughout the normal human intestinal contents. Occurring thus it appears to be non-pathogenic, but in the presence of any abnormal condition becomes highly infectious. It is believed that a simple peritoneal inflammation such as arises from hernial strangulation, the irritation of ovarian tumors, and various diseases of the abdominal viscera, is sufficient to permit its migration through the intestinal walls, thus infecting the peritoneum. It has been shown to become virulent even in venous congestion of the intestines, in diarrhœa and in constipation. Experimental observations indicate that the results of infection by this bacterium depend to a great extent on the dose of poison administered. The difference in dosage is thus made to account for different varieties of the disease. It has also been found that local conditions have considerable to do with the virulence of the infectious materials. Thus if the micro-

organisms are introduced with a fluid difficult of absorption, as blood, or a corrosive fluid capable of damaging the peritoneum, they are decidedly more active than they would be under certain other conditions.

The pyogenic cocci are the micro-organisms introduced in the case of infection arising from the uterus and ovaries.

In gonorrhœal cases, gonococci *per se* are not the active infecting agent, for it has been shown that these micro-organisms do not flourish in the peritoneal cavity. Other bacteria found in the urethral or vaginal discharge are at fault.

As already suggested, it is now almost universally conceded that the peritoneal inflammation is not the dangerous factor in peritonitis. The peritoneum, it must be remembered, is a large membrane, covering, it is said, a surface equal to the entire external integument. There is thus abundant opportunity for absorption of any organic poison within its cavity. The symptoms of the disease, moreover, are by no means proportionate to the inflammatory process. Ofttimes the most severe cases are characterized by local conditions far too slight in degree to account for a fatal issue. Besides this, the clinical phenomena in severe cases indicate almost beyond question the operation of an overwhelming poison.

Symptomatology.—The onset of acute peritonitis is always rapid. The first symptom is pain, which in cases dependent upon rupture of a hollow viscus, as in intestinal ulceration, is associated with a sensation as if something had given way within. Every influence causing any motion of the inflamed parts excites the pain to renewed activity. Thus it is aggravated by coughing, breathing, vomiting and by every motion about the bed. As a rule, it is frightfully severe, and of a tearing, cutting character. As in the case of pleurisy it is most marked at the beginning of the disease and diminishes or even disappears with the advent of exudation. The abdomen is sensitive to pressure, the slightest touch causing intense suffering. As a rule, the pain is localized in the beginning to the point of beginning inflammation, from which it spreads. Sometimes, however, it is general from its very inception. The former condition prevails with sufficient frequency to make the situation of the pain an important point for diagnosis and treatment. It must be remembered that sometimes a pain occurs in one spot while the inflammation is situated elsewhere. The discovery of points of tenderness then becomes an important matter.

Thus in peritonitis from perforation of the stomach pain may be referred to the back, the chest or the shoulder. Sometimes it is situated in or about the umbilicus regardless of the seat of disease.

As the result of the pain and tenderness the patient lies upon his back with the thighs drawn up, and flexed upon the abdomen, in order to relieve tension of the abdominal walls. The movements of the

diaphragm are restricted as far as possible, respiration becoming shallow and of the costal type.

In exceptional cases, and these generally of puerperal origin, the pain is slight or even entirely absent.

Alterations in the temperature present no fixed type. The disease is frequently ushered in with a chill, especially when sepsis is extreme. The initial rise of temperature accompanying or succeeding the chill is usually well marked, reaching 103° or 104° F. In well-marked septic cases it does not go very high, usually not higher than 101° or 102°F., and it may be normal or subnormal. When the peritonitis arises from perforation the first condition may be one of collapse. At the best the thermometer is an unreliable diagnostic and prognostic guide.

The pulse, however, is characteristic. Very early in the course of an attack it becomes rapid, small and weak. Very often it is this quality of the pulse which indicates the serious nature of the disease, even while all the other phenomena are apparently such as to occasion no especial alarm. In circumscribed peritonitis the pulse frequency is generally about 100, but when the inflammation becomes general, or the systemic poisoning profound, it rises to 130 or 150 or more.

Vomiting is usually an early symptom, being associated with the abdominal pain. The first substances vomited consist of food, later, of mucus and bile, and finally, of fæcal matter. This symptom is apt to continue throughout the course of the disease and be excited at every attempt to eat or drink. Between the paroxysms the patient complains of nausea, and refers to "a gulping up of greenish material into the pharynx." This is a pretty constant phenomenon of septic cases. The intolerance of the stomach is made all the more distressing because of the patient's great thirst, which, perforce of circumstances, he cannot alleviate.

Abdominal distention is an early and an important symptom. It is produced by the accumulation of flatus within the intestines, and leads to paresis of the muscular coat of the bowels. The condition is furthermore intensified by a weakened or flaccid condition of the abdominal walls. It is, therefore, especially well marked in puerperal peritonitis, and is less prominent in strong, muscular men. The shape of the abdomen has been compared to that of a dome. The distention is sometimes so great that the skin of the abdomen is shining and smooth. The diaphragm is forced upward and displacements of abdominal and thoracic viscera occur in considerable variety.

Hiccough is a prominent symptom of some cases. It appears to be caused by gastric disturbance or by involvement of the upper portion of the peritoneum or of the diaphragm.

The facial expression of the patient is always an important point for observation in this disease. The features are drawn, sunken, and the nose looks pointed and pinched. The expression is one of anxiety. The voice is weak.

The mental condition is anxious. Consciousness is usually preserved until the last, though it may give place to mild delirium or stupor, in which condition the patient dies.

The tongue is at first moist and slightly coated. Later it takes on the appearance common to asthenic diseases, *i. e.*, it becomes dry and brown.

The bowels are generally constipated, owing to the paretic condition of their muscular coat. Statistics taken from the London Hospital show that out of one hundred cases of peritonitis in but twenty-eight were the bowels loose, cases associated with diarrhœa seeming to offer a better prognosis. The latter condition is the usual one in cases of puerperal peritonitis.

The urine presents no characteristic features. As in the majority of febrile affections it is high-colored and scanty. When the peritoneal covering of the bladder is involved there is frequent urging to urination. The muscular coat of the bladder, like that of the intestines, may become paretic, with resulting retention of urine. This last-mentioned symptom is occasionally produced by the massive doses of opium sometimes administered in the treatment of this disease. Indican is found in large quantities.

Physical Signs.—Upon inspection the abdominal distention, to which reference has already been made, is apparent. The peristaltic movements of the intestines are often observed through the stretched abdominal walls. The abdominal muscles are rigid, and the respiratory movements are limited to the chest. With increased distention the muscular rigidity diminishes. It is rarely possible to make out the exudation itself, for it naturally gravitates to the most dependent positions, and hence must be very large in quantity before it can be detected. When exudation commences a fremitus produced by the friction of opposing peritoneal surfaces may be felt.

Percussion gives a clear tympanitic sound over the distended abdomen. The quality of the note is, of course, modified over certain areas according to the viscera below. Sometimes it is possible to make out effusion by the presence of percussion dulness in the dependent portions of the abdomen. Some years ago Flint called attention to the value of tympanitic resonance over the hepatic region as evidence of intestinal perforation. In many cases this sign has a positive value, but it is not infallible, for it is possible for a coil of intestine to come between the liver and the abdominal walls and thus change the percussion sounds in that locality. Then again this sign cannot occur when extensive adhesions have formed between the hepatic and parietal surfaces, for, in a case of perforation under these circumstances, no gas can reach that place. Regarding the discovery of exudation by percussion, it must be remembered that when the fluid is encapsuled by adhesions, the areas of per-

cussion dulness do not change with alterations in the position of the patient.

Auscultation usually discovers loud gurgling through the intestines, and sometimes, friction sounds over the inflamed peritoneal surfaces.

Diagnosis.—The diagnosis of acute peritonitis may be safely made when in the presence of a disease to which it may be secondary there set in suddenly abdominal pain and tenderness, fever, vomiting, tympanites, quick, feeble pulse and constipation. A searching investigation for a primary disease is always a very important matter, especially for therapeutic purposes. A number of conditions afford opportunities for error. These include intestinal obstruction, enteritis, enteralgia, renal colic, biliary colic, uterine colic, and hysteria.

Acute intestinal obstruction begins with griping pains, vomiting, which is often stercoraceous, soon following. The pain is often localized, and is not so apt to be accompanied by localized tenderness. Peritonitis is very apt to be accompanied by the rise of temperature already mentioned, and the rapid wiry pulse. In many cases, however, a differentiation is impossible. Both diseases have constipation, but in obstruction that phenomenon is decidedly more marked.

In *acute enteritis* pain and abdominal distention are present; but diarrhœa is the prevailing condition of the bowels. The pain is colicky in character.

In *enteralgia* the pain is relieved by pressure, and fever is absent. The absence of a cause for peritonitis and the presence of one provocative of intestinal disturbance, are valuable diagnostic aids.

In *renal colic* the pain is limited to the kidney and the course of the ureter, and is associated with evidences of calculus, as uric acid gravel, hæmaturia, etc.

Biliary colic has pain in the region of the gall-bladder which structure is distended, and jaundice appears within twenty-four hours in nearly all cases.

Uterine colic comes on during the menstrual period, and the pain is not constant.

Hysterical cases are to be recognized by the usual concomitants of hysteria. The diagnosis here is sometimes exceedingly difficult, owing to the many suggestive symptoms which develop.

Prognosis.—Acute peritonitis is always a very dangerous disease. In septic cases, especially those arising from perforation, death may result from profound shock or systemic poisoning within twelve to twenty-four hours. In the majority of fatal cases, death takes place within seven days of the onset of the disease. Peritonitis in which the exudate is serous or sero-fibrinous, while a serious affection, is not uncommonly recovered from. Unfortunately we have no data by which such cases

may be recognized clinically. Localized suppurative peritonitis if operated sufficiently early, offers a favorable prognosis. Not so, however, when by reason of delay rupture of the abscess has taken place, and a general septic peritonitis is thus produced. Favorable symptoms are improvement in the quality and frequency of the pulse, cessation of vomiting, and relaxation of the bowels.

Treatment.—The first element in the treatment of peritonitis is absolute rest, although it would seem needless to make this suggestion in view of the patient's serious illness. But rest does not mean that alone obtained by lying in bed; it includes the removal of every source of annoyance and discomfort, and functional rest of the abdominal viscera as far as possible. The patient must be made so comfortable that restlessness may find little or no excuse. The food should be limited in quantity, and carefully selected as to quality. Liquid nourishment is unquestionably the best. Milk may be given in that form in which it seems to produce the least discomfort, hot, cold, peptonized, or mixed with Vichy or soda water. If preferred, soups or broth may be administered. When the vomiting is so extreme as to make feeding by the mouth a questionable procedure, rectal alimentation must be resorted to. For this purpose the injection of a well-prepared and peptonized beef broth or whey, which may be mixed with liquid peptonoids, may be given in quantities of three ounces three or four times daily. The minimum quantity of food required for the patient's demands should be employed. While thus advising abstemiousness in feeding, care must be exercised lest it be carried to too great an extreme, and the patient made to suffer needlessly thereby. When rectal alimentation is employed, the importance of washing out the rectum at daily intervals must be borne in mind.

Early in the course of the disease the propriety of clearing out the intestinal canal may be entertained. Many laparotomists are strong advocates of the treatment of peritonitis in its early stage by the administration of saline cathartics, but their views have not found general acceptance, though obtaining considerable respect. In view of the fact that peritonitis often results from the action of the bacterium coli commune, it would seem that the complete evacuation of the intestines prior to operations on the abdomen should lessen the chances of infection, and thereby diminish the danger from peritonitis. Viewing the evil results of the disease as a toxæmia, it would also appear that the free discharge of all fæcal matters might be conducive to lessening of the amount of infection. If it is deemed desirable in any case to cause a movement of the bowels, the purgative enema recommended in the article on constipation on page 664 may be administered. In any case, however, in which there is strong reason to believe that the disease has resulted from perforation of either stomach or bowels, purgation in any way should be carefully avoided.

The relief of pain when severe is an important part of the treatment. When ordinary remedies and measures fail to bring about the desired relief, then the administration of *opium* or *morphia* becomes necessary. The latter drug is probably the more useful when administered hypodermatically. Opium given by the mouth in peritonitis is but slowly absorbed. Some old school authorities, especially Alonzo Clark, urgently recommended that the narcotic selected be pushed to the fullest extent. Such a course, however, is exceedingly unwise as well as unnecessary. Just sufficient should be given to make the patient comfortable, and no more. This quantity will also diminish peristalsis, and, in cases arising from perforation, assist in limiting the resulting peritonitis. The natural tendency of the pain to disappear with the advent of the stage of effusion must not be forgotten, and the dose of morphia reduced accordingly. The indiscriminate use of opiates is attended by serious disadvantages, inasmuch as they disguise symptoms, and ofttimes interfere with the natural process of cure.

Local applications for the reduction of the inflammation should not constitute a very important part of the treatment. In the case of a strictly localized inflammation, in its incipiency, the use of the ice bag may prove beneficial. The fact that the disease is dangerous because of its toxic effect on the system and the possible conservative nature of the inflammation, must ever be entertained. Hot applications are far more valuable than are the cold. Heat is a most useful means of lessening the pain. It may be applied by means of the hot water bag, the Japanese fire box, the electrotherm, flannels wrung out of hot water, or light flax-seed poultices. It should always be as great as the patient can comfortably bear, care being taken lest the skin be damaged.

When tympanites becomes a source of suffering it should be relieved. Then the application to the abdomen of one or two fluid drachms of a mixture of equal parts of turpentine and sweet oil beneath the poultice is beneficial. The lower portion of the intestinal canal may be relieved by a warm water enema. Some authorities have recommended that the stomach should be emptied by lavage; but to the writer such a measure seems needlessly severe if not positively harmful as it violates one of the cardinal principles of treatment, *i. e.*, absolute rest. Mild measures failing, the puncture of the distended intestines by a very fine trocar has been recommended, and may be beneficial in rare instances. While there is probably but little danger of escape of gas into the peritoneum through the small openings, this operation should always be held as a *dernier ressort.*

When the vomiting is severe, it may be relieved by the administration of pellets of ice. Sometimes hot water is a better remedy, especially when thirst is marked, as the ice seems to have a tendency to aggravate

this symptom. All other measures failing, morphia hypodermatically should be tried.

As a rule, the constipation should go untreated. The circumstances under which laxative medication is permissible have already been detailed.

When the pulse is failing, and the toxæmia is well marked, alcoholic beverages are advisable.

The advisability of operative measures must be entertained in every case. In many they are unnecessary. It is important, however, that the course of the case be carefully watched, lest too much time be spent in medicinal treatment, and the time when operation offers fair results passed by. The majority of well-defined septic cases should be subjected to laparotomy, especially so when the nature of the primary lesion indicates clearly the character of the infection. Acute general peritonitis, even when taken in its earliest stages, proves highly fatal. Still, recoveries are possible. McCosh believes that his own statistics, three recoveries in fourteen operations, represent about the general average of results. The earlier the operation is performed the better. Very few cases recover when operation is delayed longer than the second day, although good results have been obtained at a much later period, even in cases apparently hopeless. Acute circumscribed suppurative peritonitis gives very good results from operation, which is urgently called for at as early a period as possible.

Aconite may occasionally be the only remedy necessary if given in the very early stage and upon the typical group of aconite symptoms so often met with in the early stage of serious inflammatory affections. I have notes of two cases of this character occurring in young ladies, one of which was apparently the result of exposure to cold. A quick small hard pulse, anxiety, bodily restlessness, thirst, constipation, a dry skin, which may not yet be hot but with a temperature of 103° or 104° F., are some of the symptoms calling for this medicine. The first to the third decimal dilutions may be employed, and should be frequently repeated. I have not always stopped aconite at once upon selecting the second medicine, but have continued occasional doses for a day or two after commencing with *bryonia*, which is the remedy most frequently selected at this time, and which is the most valuable medicine we possess for well-developed peritonitis until the effusion becomes free or purulent. It matters not whether the peritonitis is secondary to appendicitis, inflammation of the pelvic organs, or to other intra-abdominal inflammation. It possesses little or no influence over cases which are clearly septic. Bryonia should be administered as recommended for aconite.

Should one or both of these remedies subdue the acute process in great measure they may be advantageously followed by *sulphur* in the sixth decimal trituration, which remedy hastens resolution and favors absorption of the exudate.

If the disease increases in intensity notwithstanding the use of bryonia, a new selection must be made, the most important medicines being *cantharis, mercurius corrosivus* and *arsenic. Cantharis* is preferable if the features are pinched, the pulse rapid and feeble, the abdomen much distended, the pain severe and of a cutting and burning character. The urinary symptoms of this medicine may be present. *Mercurius corrosivus* is applicable to much the same symptom group, but is preferable if vomiting is frequent, the bowels loose, or if indications of purulency of the exudate are present. *Arsenic* should be considered when general symptoms of a septic infection are prominent. It must be prescribed mainly upon its general symptoms, as in typhoid fever, or other serious forms of disease. The great prostration with thready pulse and terrible anxiety, nightly aggravations, etc., constitute a most unpromising picture, but a few cases of this character do recover and sometimes by the aid of arsenic. *Lachesis* is applicable to the same class of adynamic cases, especially when associated with a gangrenous focus, as in appendicitis. Marked sensitiveness of the abdomen to touch, a mild delirium and an aggravation on awaking and in the afternoon, are suggestive indications.

In the extreme stage of peritonitis, with rapidly failing circulation, such remedies as *veratrum album, carbo veg., colchicum* and *arsenic* are recommended, but I have observed little benefit from their use.

Belladonna and *colocynth* are not infrequently useful in the peritonitis of children, and that dependent upon pelvic disease in women, such cases being more apt to develop the prominent symptoms of these remedies.

Rhus toxicodendron, baptisia and the *mineral acids* may be called for in rather protracted cases of peritonitis which develop symptoms of the typhoid state.

Symptoms indicative of suppuration suggest *mercurius corrosivus, arsenic, arsenite of quinine* and *quinine.* Should the patient survive the acute period good service will be secured from such remedies as *hepar sulphur, silicea, sulphur* and *iodide of potassium.*

PERITONITIS IN INFANTS.

The study of peritonitis as it occurs in infants and young children involves etiological questions almost entirely. The disease may occur even during intra-uterine life, causing the death of the fœtus in most instances. In other cases the child is born with all the symptoms of the disease. All of these cases are the product of inherited syphilis. Even when not fatal the disease interferes sadly with intestinal development, because of the extensive adhesions between opposing surfaces of intestine and frequent narrowing of the intestinal lumen by cicatrices. Occurring shortly after birth, peritonitis is usually the result of septic infection from the umbilicus. Still later in life its advent is attributed to exposure

to cold, fatigue, etc. In young girls vulvo-vaginitis is an occasional cause. The general causes of peritonitis enumerated as occurring in adults are also operative in children, and need not be mentioned in this place.

CHRONIC PERITONITIS.

Etiology.—Chronic peritonitis, like the acute form of the disease, may be either diffuse or circumscribed. The former is of rare occurrence excepting as the result of tubercular infection; still, clinical evidence in its favor is sufficiently strong to make its existence unquestionable. Whether circumscribed or diffuse chronic peritonitis may result from imperfect resolution of the acute variety. The influences leading to this unfortunate result are imperfectly understood. When in the case of acute circumscribed peritonitis the effusion becomes encysted and fails to be absorbed it acts as an irritant and thus perpetuates the inflammation; especially is it likely to have this effect when the exudation is purulent. Constitutional diatheses are undoubtedly active in the production of some cases. Chronic peritonitis has also been attributed to chronic diarrhœa, typhoid fever, syphilis, measles, and exposure to cold.

Pathology and Morbid Anatomy.—The post-mortem appearances in cases of chronic peritonitis present a variety of types sufficient to enable us to recognize several distinct classes of cases which may be grouped as follows: (1) Adhesive peritonitis, which may be local or diffuse; (2) hyperplastic peritonitis; (3) chronic hæmorrhagic peritonitis. The first of these is found very frequently at autopsies. It is shown by limited adhesions in different portions of the abdominal cavity, but especially by adhesions between adjacent coils of the intestines, between the intestines and the mesentery, or between the liver or spleen and the diaphragm. Little or no inconvenience is experienced during life, the first evidence of the trouble being afforded at the autopsy. The *diffuse* form is said to be a continuation of acute general peritonitis. It is characterized by general adhesions with practical obliteration of the peritoneal cavity. Great thickening of the peritoneum is often observed. In *hyperplastic peritonitis* there is also great thickening of the peritoneum, but adhesions are absent. Effusion is present in greater or less degree, although rarely to the extent of causing marked abdominal distention. In some cases limited adhesions exist, producing encapsulation of the exudate. Extensive visceral changes are associated. *Chronic hæmorrhagic peritonitis* is a rare variety, described by Virchow, and analogous to pachymeningitis hæmorrhagica. It is apt to be localized and occur in the pelvis.

Symptomatology.—A glance at the morbid changes of chronic peritonitis, as just described, shows that the disease cannot possess a well-

defined and characteristic symptomatology. In mild cases of the circumscribed adhesive variety, symptoms are often wanting. Diffuse adhesive peritonitis following the acute disease is necessarily characterized by a continuation of the various symptoms of the acute stage, but in modified degree. Pain is present, being more intense and associated with greater tenderness over places where the inflammation is more violent. Necessarily the location of the foci of maximum pathological changes must exert an influence on the symptoms, for according as they are adjacent to intestines, liver, stomach, kidneys, ureters, bladder, uterus, or ovaries, so will the clinical picture vary. The circumscribed adhesive peritonitis sometimes produces similar disturbances.

Chronic peritonitis has no definite influence over the general health. Some of its victims are apparently in good general condition. In other cases there is progressive emaciation, vomiting after eating, nausea, irregularity of the bowels, constipation alternating with diarrhœa, the usual symptoms of gastric or intestinal indigestion, and anæmia. The temperature may be normal, or there may be marked fluctuations, the maximum elevation in the twenty-four hours being in the latter part of the day.

The abdomen may be either flat or distended. When the latter, the maximum degree of effusion may be attained early or late. In some cases the abdomen becomes greatly distended within three or four weeks. This symptom presents marked variations in intensity from day to day, without any corresponding changes in the other manifestations of the disease. With the onset of profuse diarrhœa or diuresis it is very apt to diminish greatly. When the exudate is not sufficiently great to interfere with proper examination of the abdomen, extensive thickenings appearing almost as tumors may be discovered by palpation.

Sometimes encapsuled exudates undergo partial absorption and calcification.

Diagnosis.—In the absence of effusion or the history of an acute peritonitis, which has probably acted as the causative agent, the diagnosis of chronic peritonitis is attended with the greatest difficulty. One can only surmise its existence when by a careful study of the clinical history of the case, he is enabled to exclude ascites as the result of liver, heart or kidney disease, and the various lesions to which the abdominal viscera are subject.

Prognosis.—In view of the diagnostic difficulties no definite prognosis can be given. Very many cases make complete recovery, especially when the inflammation is circumscribed. When, however the abdominal viscera become involved and emaciation and anæmia are well marked, the case is apt to have a fatal termination, the patient dying of marasmus.

Treatment.—The treatment of chronic peritonitis must be conducted on the general principles already laid down for the treatment of the

acute form. The patient in all cases should have plenty of rest and fresh air. The diet must be nourishing and readily digested. When the effusion is abundant, paracentesis is the proper measure, which often of itself proves curative. Repeated tappings are beneficial. Laparotomy should be resorted to when medicinal and hygienic treatment fails. The remedies recommended in the treatment of the acute form are also indicated here. In addition, we may also think of *apis*, *calcarea carb.*, *aurum mur.*, *iodide of potassium* and *sulphur*.

ASCITES.

Synonyms.—Abdominal dropsy; hydroperitoneum; hydrops peritonei vel abdominis.

Definition.—The term ascites is ordinarily used to denote an accumulation of serous fluid in the peritoneal cavity arising from any cause. Common usage tends to limit the application to cases in which peritonitis does not exist.

Etiology.—A proper understanding of the method by which portal obstruction produces ascites necessitates a few introductory words concerning the anatomy of the portal vein. Tributary to this vessel are four principal veins, which collect the venous blood from the gastro-intestinal tract. They are the inferior and superior mesenteric, the splenic and the gastric veins. Their distribution is such that they drain a very extensive portion of the abdominal contents. The portal vein is formed by the junction of the superior mesenteric and splenic veins. It passes through the right border of the lesser omentum, enters the transverse fissure of the liver and then divides into two branches. Further divisions and subdivisions take place, the branches of the portal veins accompanying those of the hepatic artery throughout the substance of the liver. Its capillary divisions become continuous with the terminal branches of the hepatic vein.

The fact that pressure on a venous trunk or obstruction within its lumen will produce transudation of serum is well known. This is as true of the portal as of all other veins. Direct mechanical obstruction then becomes an important cause of dropsy of the peritoneum. This obstruction may be exerted on the main trunk of the portal vein, or it may be a general interference with the onward passage of the blood through its radicles in the liver. From the first of these causes ascites is a symptom of tumor of the pancreas, omentum, or liver, aneurism of the hepatic artery, and inflammatory thickening of the peritoneum. Sometimes the obstruction is due to the direct pressure of the tumor; in other cases it is the result of thrombosis of the portal vein. The pressure first produces thrombosis and this latter process still further intensifies the obstruction.

The liver diseases capable of interfering with the portal circulation

show changes throughout the entire gland. The best example of such, and the one which more frequently than any other causes ascites is cirrhosis, in which affection the connective tissue-overgrowth contracts on the minute branches of the portal vein and produces portal obstruction. A general cancerous infiltration of the liver or syphilitic disease sometimes produces the same result.

General circulatory obstruction is also accountable for the production of ascites, as in cardiac and renal disease. In these cases, however, the ascites is always associated with dropsy of other portions of the body.

Under normal conditions there is a slight transudation of serum through the bloodvessels of the peritoneum. This fluid is quickly taken up by the lymphatics and hence gives rise to no inconvenience. Malignant tumors of the peritoneum sometimes interfere with the absorption of this fluid and ascites results.

Pathology and Morbid Anatomy.—As a rule the peritoneum itself shows but few changes. It may be slightly œdematous; or, in old cases, it may exhibit numerous opacities and thickenings. When as the result of previous attacks of peritonitis, adhesions have formed, the effusion becomes encapsulated; thus we have saccular ascites. Peritoneal changes are especially apt to be observed in cases which have been subjected to frequent tappings.

The ascitic fluid is a limpid, pale, yellow fluid, having a specific gravity ranging from 1010 to 1015. Departures from this standard are observed. Thus it may possess a greenish or brownish tint from the admixture of the coloring matters of the bile or blood respectively. Sometimes too it is somewhat viscid in its consistence. In some cases it is of a milky hue owing to the presence of chyle (*chylous ascites*) or fat (*adipose ascites*). The ordinary chemical reaction of ascitic fluid is alkaline; very exceptionally it is neutral or acid. On standing it deposits a sediment which consists of leucocytes, granular or fatty cells, red blood corpuscles and cholesterin. The red blood-cells are more numerous in the cases dependent upon general venous obstruction. The fibrinous constituent of the effusion leads to the formation of a delicate clot.

Chylous ascites is a very rare condition, less than fifty cases having been recorded in literature. It is, moreover, very fatal, but two of the cases having recovered. It is due to rupture of the thoracic duct, receptaculum chyli, or lacteal vessels, caused by distention of these vessels resulting from repletion or disease of their walls, and obstruction to the onward progress of the chyle. The obstruction is usually produced by tumors, enlarged mesenteric glands, peritoneal thickenings, adhesions and cardiac disease. Sometimes the obstruction is found in the thoracic duct at or near its point of entrance into the subclavian vein, in which case a chylous effusion appears in the left pleural cavity. The specific gravity

of the fluid is high, *i. e.*, 1023; the percentage of albumin, 3 to 5.5 per cent.

In fat or adipose ascites, the fat particles are in drops. This condition appears especially in cancer or tuberculosis of the peritoneum, and is due to fatty degeneration of portions of the growth.

Symptomatology.—The symptoms of ascites are the result of the mechanical action of the accumulation. They are both subjective and objective, the former being more prominent when the effusion takes place rapidly and when the quantity of fluid is large. General symptoms are also present in the majority of cases, but these, as a rule, are attributable to the primary pathological state of which the ascites is the result.

It is very rare for the effusion to give rise to subjective symptoms before it is sufficiently great to produce some abdominal enlargement. Then there appear abdominal uneasiness and discomfort. If the accumulation is at all great, the discomfort partakes of the sensations of fulness and tension. Abdominal pain is rarely present, or if it does exist it has no special features. Sometimes extreme distention gives rise to pain, or paroxysmal pains of a colicky character are a source of considerable annoyance. Naturally the carrying of the weight of the peritoneal effusion causes more or less aching and sense of fatigue, manifested particularly about the loins and the abdominal walls. In order to better maintain his equilibrium and counteract the effect of the protuberant abdomen, the patient throws his shoulders and head well backward and stands or walks with his legs wide apart. The pressure of the effusion on the stomach causes symptoms referred to that organ. The introduction of a small amount of food, in some instances, provokes vomiting. In others the slightest flatulence produces great discomfort. Sometimes hiccough proves to be a very distressing symptom.

Large accumulations of fluid lead to upward dislocation of the liver and crowding upwards of the diaphragm and the abdominal viscera. The line of hepatic dulness in such cases may reach as high as the third rib. The heart and lungs are likewise affected. The bases of the latter may be so compressed as to constitute atalectasis. The apex beat of the heart is raised and carried to the left, and auscultation reveals as the result of the dislocation a basic systolic murmur. Respiration is of the upper costal type; the abdominal muscles do not participate in the act excepting to a slight degree. Rare instances, however, have been observed in which, notwithstanding the extreme abdominal distention, respiration by the abdominal muscles was unimpeded. As a result of all this thoracic compression, more or less marked dyspnœa is manifested. It is especially aggravated by the recumbent posture, for then the peritoneal effusion can exert greater mechanical pressure on the diaphragm; after eating, because of the increased distention of the stomach by food or flatulence; and after very slight exertion, because of the increased

demands on the already embarrassed heart and lungs. The interference with the heart is often sufficiently great to excite attacks of faintness and palpitation.

Physical Examination, however, affords the reliable evidence by which ascites is recognized. Inspection reveals a uniform enlargement of the abdomen, the history of the case showing that this swelling was at first most marked low down when the patient was in an erect posture. The shape of the enlargement varies with the position of the patient; when he is lying down there is bulging at the flanks; when standing or sitting, the lower abdomen becomes more prominent. The enormous distention stretches the skin of the abdomen, which becomes thin and shining. The cutis may rupture and reddish-blue or rosy-red stripes appear. With time these become white, as in the case of the linea albicantes of pregnancy. The umbilical depression is obliterated, and in extreme cases, even everted. If there happens to be any local weakness in the abdominal walls, as in hernia, there is apt to be a bulging at that particular point.

As compared with the distended abdomen, the chest seems small. The margins of the lower ribs are everted and the lower portion of the thorax broadened.

Enlargement of the superficial veins of the abdominal walls is sometimes present. Usually there are found two principal veins, each starting from about the middle of Poupart's ligament on either side, coursing upward and joining the veins of the thorax. Such a condition is significant of portal obstruction. In other cases, numerous veins are observed radiating outward from the umbilicus. Sometimes these veins are so enlarged as to receive the designation of *caput medusæ*.

Palpation likewise furnishes very valuable diagnostic aid. The distended abdominal walls are perfectly smooth and give a sensation of tension and slight fluctuation.

In noting the presence of fluctuation in ascites a special method of examination is necessary. One hand is placed lightly on the side of the abdomen not far from the median line. The fingers of the other then strike a quick blow on the other side. If ascites be present, a distinct wave or a series of waves will be transmitted to the palpating hand. This test is easy of application in thin subjects. In the adipose, the vibration of the fatty deposit in the abdominal wall is a source of confusion. This may be eliminated by directing an assistant to hold the edge of a piece of cardboard firmly along the median line.

Another way of palpating in ascites is that sometimes referred to as "dipping for the liver." The fingers are applied to the abdominal wall over the liver. With a sudden movement of the hand, the abdominal wall is depressed, the fluid within is pushed aside and the solid organ beneath is felt with a distinctness that would be impossible were no effusion present.

The application of PERCUSSION to ascites necessitates the examination of the patient in different positions in order to secure positive results. Dulness is obtainable in dependent positions, in other words, over the effusion; tympanitic resonance is obtainable wherever the intestinal tract comes in contact with the abdominal parietes. When the effusion is small, the fluid gravitates into the pelvis and hence is not ordinarily recognizable. Under such circumstances the hips may be raised or the patient placed in the knee-chest position. With the patient lying on his back, tympanitic resonance is found about the umbilicus and the flanks are dull on percussion. In all cases the line of demarcation between dulness and tympany is well defined. There are several sources of error in the percussion of an ascitic patient. Sometimes by reason of an unusually short mesentery, the intestines cannot rise to the surface of the effusion when the patient is on his back. Hence the percussion dulness is general. In still other cases, they cannot come to the front because they are bound down by adhesions. When the colon is considerably distended a tympanitic percussion note is obtainable on both sides of the abdomen notwithstanding the presence of effusion. The physical signs of ascites are sometimes masked by inordinate abdominal distention and by pathological conditions of the abdominal viscera.

Ordinarily, the signs just given are all sufficient diagnostic aids. Sometimes in women unusual difficulties arise. Recourse must then be had to digital examination of the rectum and vagina. As already stated, the fluid gravitates to the pelvis, and is found in the recto-vaginal *cul-de-sac*. Palpation of the anterior rectal wall gives a sense of fluctuation. The vagina is shortened, and the uterus is pushed down and forced from its normal angle.

In some cases, ascites is associated with œdema of the abdominal walls. Sometimes the skin cracks and oozing of serum takes place, or there may be an erythematous appearance, ulceration, or even gangrene of the parts.

Diagnosis.—The symptoms and physical signs already given are usually sufficient for establishing a diagnosis; yet mistakes will occur. The shape of the abdomen, the wave-like sensation upon percussion and palpation, the dulness changing in location with variations in the position of the patient, and the prominent umbilicus, are the most important. The diagnosis is aided by a knowledge of the presence of visceral disease capable of producing peritoneal effusion. The conditions with which ascites may be confounded are: chronic peritonitis with effusion, unilocular ovarian cyst, distended bladder, and dilated stomach.

In *chronic peritonitis with effusion* there are pain and elevation of temperature; and if the trouble is tubercular, as it usually is, there will be manifestations of tuberculosis in other portions of the body.

In *unilocular ovarian cyst* the area of dulness presents a line with its

convexity towards the head of the patient; in ascites the convexity of the dividing line is often downward. With the patient lying on the back, the abdomen is flattened anteriorly and bulging at the flanks in ascites; in ovarian cyst the abdomen is protuberant. In ascites the umbilicus is protuberant, not so in ovarian cyst. The abdominal enlargement in ascites is uniform; in ovarian cyst it is limited to certain parts. In the latter, the percussion waves are confined to the dull areas.

A *distended bladder* has several times caused serious mistakes. The situation of the enlargement and the use of the catheter are the diagnostic data.

Strange to say, a *dilated stomach* has several times been mistaken for ascites. The enlargement begins above and progresses downward. Long before the abdominal enlargement becomes an important symptom, stomach symptoms will have been manifest.

An examination of the fluid removed by tapping furnishes a guide as to its nature. Ascitic fluid has a specific gravity of 1010 to 1015, that of peritonitic effusion 1015 to 1025. The fluid in cancerous peritonitis generally has a high specific gravity.

Prognosis.—The prognosis of ascites is generally unfavorable because of the serious lesions of which it is a result. The future of any given case must therefore be decided after the extent of the original disease has been determined. Exceptionally there are cases observed in which the effusion has disappeared after a single tapping; in the majority, however, the fluid returns time after time. The rapidity with which effusion takes place is subject to great variations. Shattuck reports one case in which it became a source of danger within five days of its commencement. In any case it is a mistake to pay too much attention to the ascites at the expense of the disease of which it must be regarded as a symptom.

Treatment.—Slight peritoneal effusion producing no symptoms or entailing no immediate danger to the patient should go untreated so far as special measures directed to it are concerned. Active medicinal measures directed to the absorption of the fluid by purgation, diuresis, and diaphoresis are unwise and probably effect more harm than good if employed when contra-indicated. The employment of hot air as a means of securing active elimination by the skin is to be commended, but must not be persisted in if it produces too much discomfort. The patient is to be divested of his clothing and seated on a chair. A large woollen blanket is secured closely about his neck, while its folds cover his body and the chair. Beneath the seat of the latter an alcohol lamp is placed. In a short time the air within reaches a high temperature. This procedure sometimes occasions severe headache or a sense of faintness, which may be obviated by wrapping iced cloths about the head. The duration of the séance should be about fifteen minutes. When the

patient is confined to his bed the hot air may be introduced beneath the bed-clothing through a piece of tin water-spout, the alcohol lamp being placed on the floor and the outer end of the spout a short distance above the flame.

Several cases of ascites in which the daily application of faradism to the abdomen has done much good have been reported.

The principal remedies in the treatment of ascites are *arsenicum*, *apocynum cannabinum*, *acetic acid*, *cinchona* and *apis mellifica*. Numerous other remedies are likely to prove useful by reason of their therapeutic relation to the morbid condition of which the ascites is symptomatic. *Apocynum* probably enjoys a greater reputation than any other remedy in this as in other forms of dropsy. It is best given in the fluid extract in doses of four or five drops three or four times daily, or as an infusion, twenty drops of the officinal preparation being given every three or four hours. Evidence of its beneficial action is found in increase in the excretion of urine. Some patients do not take this drug well because of the nausea it sometimes produces. Under these circumstances it may be given by the rectum well diluted with water or whey. The infusion of *digitalis* may be employed in the same manner. *Arsenicum* is useful in cases in which the ascites is part of a general dropsy, or in which the trouble is secondary to disordered or cirrhotic liver from alcoholic excesses. The urine may be scanty and albuminous. It is also adapted to cases occurring in conjunction with chronic heart or renal disease and dyscrasic blood states. *Cinchona* is best suited to ascites dependent upon splenic disease or anæmia. Special indications for its use are diarrhœa immediately after eating, thirst, hunger and scanty urine containing a whitish or yellowish-red deposit. The *chloride of gold and sodium* 2x is of value in hepatic cirrhosis, and for this reason is adapted to the treatment of ascites. *Helleborus* and *iodine* are applicable to cases dependent upon tubercular peritonitis. Under the former remedy there is a febrile movement accompanied by chills; in the latter there are great emaciation, anxiety, canine hunger and dark scanty urine.

Medicinal and hygienic measures failing to relieve the ascites, and the symptoms arising from the dropsical accumulation becoming very distressing, paracentesis abdominis becomes a necessity. This little operation though a simple one, should be performed with careful attention to detail. If the patient can sit up, he should be placed in a chair and carefully supported on either side. If too weak for this position he may be placed in a reclining position in bed with pillows behind him to support his body and head. The abdomen should be carefully washed with some antiseptic solution, such as bichloride of mercury solution, 1: 2500. The sensibility of the skin at the seat of puncture may be blunted by the application of ice, or spraying with ethyl chloride, although this is not necessary in most cases, for the pain of the puncture

is but momentary and is not very severe. The trocar and canula selected should be of moderate size, *i. e.*, one having a diameter of about one-eighth of an inch. Before making the puncture care must be taken that the bladder is empty, and that no coils of intestine are in the way. The puncture made, the trocar is to be withdrawn and the fluid permitted to flow until the peritoneal cavity is emptied. During the evacuation the abdomen should be evenly compressed by a bandage about the body so arranged as to exert equal pressure. After withdrawing the canula the wound should be closed with a piece of adhesive plaster, the abdominal bandage secured and the patient put to bed.

Syncope sometimes follows the sudden withdrawal of ascitic fluid. This accident is generally averted by the application of the pressure bandage to which reference has been made. If it should occur despite the usual precautions, the injection into the peritoneal cavity of a quart or more of a sterile solution of common salt (a teaspoonful to the pint) at the temperature of the body, acts as a prompt restorative. The quantity of salt solution employed will depend upon the quantity of ascitic fluid withdrawn.

The fluid reaccumulates very rapidly as a rule, so that repeated tappings are often necessary. They should be made as few as possible, for the loss of large quantities of fluid must prove a serious drain on a patient already debilitated by chronic disease.

TUMORS OF THE PERITONEUM.

Tumors of the peritoneum include both the benign and the malignant varieties. The former, calling for surgical treatment as a rule, are of especial interest to the surgeon. The malignant growths are beyond the aid of the knife, and while but little can be done for the relief of their victims, that little is to be accomplished by medical treatment. The benign tumors most commonly observed are the lipomata, dermoid and serous cysts, echinococcus cysts, fibromata, chylangiomata, and teratoid tumors. The malignant growths of the peritoneum are carcinomata, sarcomata, and malignant adenomata.

CANCER OF THE PERITONEUM.

Etiology.—The vast majority of cases of malignant growths in the peritoneum are secondary to the occurrence of similar formations in other structures, but principally to cancers of the abdominal viscera. In but two out of the twenty-two cases collected by Bristowe from the St. Thomas Hospital records was the growth limited to the peritoneum. The disease usually spreads by extension from the stomach or intestines, less frequently from the liver, genital organs, and retroperitoneal glands. Sometimes it results from metastasis, in which case the œsophagus and mammary glands have a number of times been the primary focus of in-

fection. Peritoneal cancer is essentially a disease of adult life, for in but one of Petrina's collection of forty cases was the patient less than twenty years of age, and in but six less than forty. As in the case with cancer elsewhere, traumatism has been an assigned cause, but its etiological significance is far from established.

Pathology and Morbid Anatomy.—The varieties of cancer involving the peritoneum are the scirrhous, melanotic, medullary, and colloid. A variety running an acute course, and characterized by the formation of numerous grayish-yellow or white nodules throughout the peritoneum, and known as miliary carcinoma, has been described. The superficial resemblance of the lesions to peritoneal tuberculosis gives it special interest. Malignant disease of the peritoneum may manifest itself in the formation of solid tumors, which may attain an enormous size, as those of the colloid variety, or a cancerous infiltration of the serous membrane takes place, transforming it into a thick hard structure. In all varieties compression or cicatricial contraction leads to important changes in the functions of the abdominal viscera, the symptoms resulting from which present great variety. Extension of cancerous growths of the peritoneum takes place by spreading, or by the contact of one peritoneal fold with another. Peritonitis is by no means a necessary concomitant condition, although it is of frequent occurrence. There is nearly always some effusion, which may amount to a few ounces or to many pints. The fluid presents important differences from the characteristics observed in simple ascites. It contains an undue proportion of blood elements, and is sometimes milky in appearance owing to the presence of oil-drops (*adipose ascites*) derived from fatty degeneration of portions of the growths.

Symptomatology.—Although the symptoms attendant upon cancer of the peritoneum are decidedly obtrusive, they are by no means characteristic. Very exceptionally a case will be observed in which the disease runs its course with but little suffering to the patient. The symptoms may be epitomized as those incident to peritonitis, malignant tumors, and intestinal obstruction. Pain is nearly always present, as in malignant growths elsewhere. It may be due to the complicating peritonitis, in which case there is more or less tenderness, to intestinal disturbance, or even to constipation. It may be continuous or paroxysmal.

Some effusion is nearly always present. Its characteristics have already been mentioned. The average quantity is stated as eight pints.

Fever is a very uncertain symptom. It is present when there is a complicating peritonitis and in cases of miliary carcinoma. Its prominent features simulate those of tubercular peritonitis very closely.

As accidents sometimes resulting from peritoneal cancer, hæmorrhage and intestinal perforation from ulceration may be mentioned.

The effusion is generally sufficiently large to make the recognition

of the tumor by palpation and percussion a matter of considerable difficulty.

The anæmia and cachectic appearance incident to malignant disease in any portion of the body are early phenomena of cancer of the peritoneum.

Diagnosis.—When there is a history of preceding growth in any portion of the body, the diagnosis of peritoneal cancer becomes an easy matter in the presence of the symptoms just mentioned. When, however, the disease is primary or starts in the retroperitoneal glands, great diagnostic difficulties are encountered. These cases resemble tubercular peritonitis very closely, from which they are differentiated, however, by the absence of tubercular disease elsewhere, their rapid course, and the presence of the cancerous cachexia. Portions of the solid tissue found in the fluid removed by tapping should be examined under the microscope, and will afford valuable information. Rectal and vaginal examination should constitute an important part of the physical examination of the patient.

Prognosis.—The prognosis of peritoneal cancer is absolutely unfavorable.

Treatment.—But little can be done in the way of treatment. Removal of the tumor is always out of the question. We are, therefore, limited to the application of measures designed for the relief of suffering. When pain is severe and uncontrollable, morphia becomes a positive necessity. When the abdominal distention is great, the exudate may be removed by tapping. This procedure should be postponed as long as possible, for the fluid will soon return and its frequent withdrawal will lead to the patient's exhaustion. Then, too, the many punctures of the trocar afford points of irritation favorable to the spread of the malignant disease. Remedies must be prescribed on a purely symptomatic basis, selecting those which have been of most service in the treatment of carcinoma in other parts, as there have been no clinical suggestions as to the value of any one drug in the treatment of cancer of the peritoneum.

INTRAPERITONEAL HÆMORRHAGE.

Synonym.—Hæmatoperitoneum.

Definition.—Hæmorrhage into the peritoneal cavity.

Varieties.—Intraperitoneal hæmorrhage is always a secondary disorder, resulting either from traumatism, or previously existing disease of the peritoneum or its bloodvessels, or of the abdominal and pelvic viscera. It may be either circumscribed or diffuse. In the former, which is by far the more frequently observed in practice, the effusion is limited by old peritoneal adhesions or anatomical structures. It is generally situated in the pelvic cavity and is then known as pelvic hæmatocele.

The term pelvic hæmatoma is used to designate an effusion of blood into the subperitoneal connective tissue.

Etiology.—Traumatism is one of the most frequent causes of diffuse peritoneal hæmorrhage, the injury producing a laceration of one of the large abdominal viscera, as the liver, kidneys or spleen, or rupture or perforation of a bloodvessel. Aneurism of any of the abdominal vessels may burst and thus lead to the condition. It has also resulted from the rupture of enlarged veins caused by portal obstruction. In certain instances, fortunately rare, the operation of tapping for ascites has been followed by free internal hæmorrhage due to the puncture of a large or dilated peritoneal bloodvessel by the trocar. Various organic diseases of the abdominal viscera, especially those of a malignant character, are associated with enlargement and degeneration of the local bloodvessels, which are thus liable to rupture under the influence of very slight exciting causes and so cause a free flow of blood into the peritoneal cavity. Scurvy and purpura are rare though positive causes of intraperitoneal hæmorrhage.

Circumscribed peritoneal hæmorrhage is more common than the diffuse variety, and especially is this true of pelvic hæmatocele. Many causes have been assigned as giving rise to this condition, but the present tendency is to the belief that the majority of cases (of the severe ones at least) are the result of a ruptured tubal pregnancy. As a matter of observation pelvic hæmatocele occurs at a period of life when the genital organs are functionally the most active. Menstruation and its disorders have therefore been regarded as possessing an important etiological influence. Thus it has been attributed to the escape of blood through the fimbriated extremity of a Fallopian tube. It is doubtful, however, if this accident is possible when the tubes are sound and of normal calibre. Other causes assigned are sexual intercourse during the menstrual period, the chilling of the surface of the body or getting the feet wet during menstruation.

Changes in the vascular structures are undoubtedly important predisposing factors. A varicose condition of the veins about the ovaries and tubes and around the uterus has been found. Under these circumstances, an undue exertion or a slight traumatism proves all sufficient to bring about vascular rupture.

A class of cases sometimes spoken of as the cachectic occurs during the course of certain general diseases, notably certain of the eruptive fevers, variola, scarlatina, measles, hæmophilia and phosphorus poisoning.

The influence of peritonitis as a cause of extensive hæmorrhage is exceedingly doubtful, although the possibility of such a relation must be admitted. Were peritonitis a frequent cause of intraperitoneal hæmorrhage, that accident would often be preceded by inflammatory symptoms, a sequence of events which is rarely observed.

Morbid Anatomy.—While pelvic hæmatocele may appear in any position within the pelvic cavity, it is nearly always, for anatomical reasons, found in the retro-uterine space. Peri- and ante-uterine accumulations of blood may be observed, but, as a rule, not unless the *cul-de-sac* of Douglas is already filled or has been obliterated by previous pathological changes. Occasionally, small blood masses are entangled in the vesico-uterine space and there remain notwithstanding the freedom of the utero-rectal space.

Peritonitis is liable to occur secondarily to the hæmorrhage. A false membrane about the clot is formed, and this not infrequently is mistaken for peritoneum. From the pseudo-membrane fibrous prolongations are sent into the mass. Other extensions take place, until the clot has the appearance of being traversed by bands of connective tissue. Finally the clot is organized.

In diffuse peritoneal hæmorrhage the effused blood is found throughout the peritoneal cavity, lying between the different organs. In many places it forms large coagula, the tendency being to the settling of the blood in the most dependent portions of the cavity. The hæmorrhage is never so great as to produce abdominal distention, as in ascites.

Symptomatology.—The symptoms produced by intraperitoneal hæmorrhage present important variations, according to the quantity of blood effused and the portion of the peritoneal cavity to which it is limited. In the diffuse variety the quantity of blood poured out is large and the accident giving rise to it is a serious one. We note as symptoms all the phenomena of profuse loss of blood, namely, general pallor and coolness of the surface, sunken countenance, anxious expression of the face, clammy perspiration, embarrassed respiration, weak thready pulse, blurring of vision, tinnitus aurium and collapse. The sudden entrance of the large quantity of blood into the peritoneal cavity by pressure causes considerable pain, which at first may be localized to the seat of vascular rupture. In other cases it is diffuse and its topography possesses no diagnostic importance. Frequently the pain is neuralgic in character and extends even into the lower extremities. As the parts become accustomed to the pressure the pains subside. In the absence of a history showing the existence of a cause for intraperitoneal hæmorrhage, the diagnosis of this condition is not an easy feat.

Pelvic Hæmatocele may be best described by considering the symptoms as they appear in three classes of cases, the classification being based entirely upon the severity of the accident as follows: (*a*) the grave or cataclysmic; (*b*) the severe; and (*c*) the mild.

(*a*) The Grave Form. The symptoms are of sudden onset. There appears severe cramp-like abdominal pain, which in some cases is preceded by a slight pain of dull character. This is followed immediately by all the phenomena characteristic of severe hæmorrhage. The patient

is restless or lies on her back with the thighs flexed upon the abdomen. She usually sinks rapidly and dies within twelve to twenty-four hours. Should the initial collapse be survived, decomposition changes in the clot may ensue, their occurrence being announced by the appearance of chills, fever and the usual concomitants of septicæmia.

Physical examination reveals an illy defined mass in the hypogastric and lower portion of the umbilical regions. Abdominal enlargement is slight though evident. When extreme distention is noted, it is due to meteorism from intestinal paresis. By vaginal examination, a sense of fulness in Douglas's *cul-de-sac*, and in the broad ligaments, may be detected. Later, when the blood has undergone coagulation, the fulness gives place to a tumor-like mass, the margins of which, however, are not well defined. As time goes on, it becomes still firmer, until finally it is quite resistant.

(*b*) The severe form is the one usually encountered. The symptoms are the same as in the grave variety, but the profound prostration and collapse are absent. It may even occur without any alarming symptoms. There is no evidence of the effusion by abdominal examination. By the vagina, the presence of the blood in Douglas's *cul-de-sac* is detectable.

(*c*) The mild form. This may be ushered in without subjective symptoms. Rectal or vaginal examination may demonstrate the cause of the impairment of health, which is usually of an indefinite character.

The frequency with which peritonitis supervenes on pelvic hæmatocele seems to afford matter for difference of opinion. Some doubt the frequency of the sequence, claiming that the presence of blood rarely if ever sets up peritoneal inflammation. As stated in the article on peritonitis, infection of the peritoneum readily takes place in the presence of a fluid like blood difficult of absorption. The clinical history of hæmatocele shows the subsequent appearance of inflammatory symptoms in a large number of cases. As a rule, these are mild, although they may be of the most severe grade.

The mechanical action of the effused blood is very apt to cause symptoms referred to the adjacent organs. Thus there are noticed irritability of the rectum and bladder, bearing-down pains, and menstrual disturbances.

Some of the milder cases show a disposition to aggravation with the recurrence of each menstrual period. This has led to the supposition that at such times there is a return of the hæmorrhage. Such a conclusion is not justified by the facts at our disposal, for the aggravation may just as well be due to the local congestion present during menstruation. It has also been observed that the pelvic changes at these times promote absorption, for, following the periods, convalescence proceeds more rapidly.

Diagnosis.—When intraperitoneal hæmorrhage takes place after

traumatism, or in a person who is known to be the subject of malignant disease of one of the abdominal viscera, or of aneurism of one of the abdominal arteries, the sudden shock and collapse are usually sufficiently diagnostic. It is very different, however, when the same symptoms appear in the midst of what is apparently perfect health. The association of collapse with severe abdominal pain is strongly suggestive of acute irritant poison. In most of these cases, especially those running a rapidly fatal course, a differentiation may be impossible. The physical signs in the case of intraperitoneal hæmorrhage denote a suddenly appearing effusion, the nature of which is to be surmised because of the mode of onset and the evidences of acute anæmia.

A retroflexed pregnant uterus may be mistaken for retro-uterine hæmatocele. In hæmatocele the uterus and the tumor are found to be distinct. Besides we have the previous history of the case which in a retroflexed pregnant uterus gives all the ordinary phenomena of pregnancy.

Rupture of an ovarian cyst is said to have been mistaken for hæmatocele. Such an error seems hardly possible, although the symptoms of the two conditions coincide at times. When the ovarian tumor is sufficiently large to produce such severe symptoms by its rupture, it must have been prominent enough to make its presence known by the most casual inspection.

Prognosis.— Intraperitoneal hæmorrhage is a serious accident, generally proceeding rapidly to a *fatal* issue.

The grave form of hæmatocele is nearly always fatal, as are many of the severe form. In some instances the effused blood is slowly absorbed. In others inflammatory changes or septic infection occur with all their complications. Rupture of the sac may then take place into adjacent parts, especially into the rectum or vagina. The latter point of exit is unquestionably the most favorable, for an opening into the rectum affords every opportunity for additional infection, gangrene even resulting. In some instances the bladder has been perforated and pyelo-nephritis has ensued.

In the more favorable cases, after a period of ill-health lasting for from six months to a year, the effusion is nearly absorbed and a practical recovery secured.

In less fortunate ones permanent invalidism results, the patient suffering from general asthenia, dysmenorrhœa and a long list of pelvic symptoms.

Treatment.—In all cases of intraperitoneal hæmorrhage the first measure is absolute rest. In traumatic cases it is important to operate at once (providing shock is not too profound) in order to stop the bleeding. With the symptoms of severe hæmorrhage salt transfusion and warm applications to the extremities, and the administration of tincture

of *cinchona* in ten-drop doses every half hour, constitute the only available treatment, unpromising though they are in their results.

In pelvic hæmatocele, the patient should be placed on her back with the head and shoulders elevated. In this position the escaping blood gravitates to the pelvis, exerts pressure on the ruptured vessels and tends to lessen the outflow. Absolute quiet must be enjoined, and the bladder catheterized at regular intervals. As to propriety of operation, each case must be decided on its merits, after consultation with a skilled laparotomist.

After the acute symptoms have subsided, the propriety of operation has been a matter of discussion. The prevailing opinion favors an expectant plan as long as there are no distressing or dangerous symptoms demanding relief.

PNEUMO-PERITONEUM.

Definition.—Escape of air or gas into the peritoneal cavity.

Etiology.—The usual cause of the presence of gas in the peritoneal cavity is perforation of the walls of the stomach or intestines. It is said also to have been produced by transudation through the intact intestinal wall. It may arise undoubtedly from the decomposition of the products of septic inflammation of the peritoneum. As in the case of hæmorrhage, the accumulation may be diffuse or circumscribed, the latter condition being the result of adhesions which prevent the dissemination of the gas throughout the entire peritoneal cavity.

Symptomatology.—There are no definite symptoms peculiar to pneumo-peritoneum. Physical examination affords some diagnostic aid. In the diffuse form there is uniform distention of the abdomen, especially prominent in the epigastrium when the patient lies on the back. Percussion over the entire abdomen is decidedly tympanitic in quality, even over such large solid organs as the liver. Inasmuch as there is peritoneal effusion of serum or pus associated with the gaseous accumulation, auscultation will reveal a well-marked splashing sound on succussion.

Treatment.—This must be conducted with attention to the primary affection of which the pneumo-peritoneum is the result.

AFFECTIONS OF THE LIVER.

GENERAL CONSIDERATIONS RELATING TO DISEASES OF THE LIVER.

Disorders of the liver have always held a foremost place in the estimation of the laity as well as in the opinion of the less-informed members of the profession; at least, a prominence not justified by positive information. Almost any form of disorder of the digestive function and many groups of symptoms related to more distant parts being attributed to affections of this organ, has constituted it a veritable cloak of ignorance. Disorders of liver function have been, until quite recently, and are even now imperfectly understood. There is at present much relating to the functions of the liver, and to its functional disorders, with which we are but imperfectly acquainted. Aside from the production of bile and its glycogenic function, this organ is related to metabolism, to the development of urea or uric acid, and is also concerned with the disintegration of the red blood corpuscles, peptones, and the elimination of morbid products. Through the influence of morbid change in the liver upon the portal circulation disorders of the various organs whose vessels are tributary to the portal vein are common. Hyperæmia, catarrh, and hæmorrhage, are the most pronounced local conditions. Disorders of a general character due to altered blood and secondarily from the changes which may have been set up within the abdominal cavity, are not uncommon. Not infrequently varieties of hepatic disease involve the bile and the biliary passages.

Relative Anatomy of the Liver.—The liver is the largest gland in the body, weighing from fifty to sixty ounces. It represents about one-fortieth of the body-weight in the adult, and from one-twentieth to one-thirtieth of that of the young child. It is supplied with blood by the hepatic artery, and receives that of the portal vein, all blood leaving by the hepatic vein.

The under surface of the organ is divided into five lobes by as many fissures. The fissures are (1) the *longitudinal*, separating the right and left lobes; (2) the *transverse*, through which the vessels and nerves enter the organ; (3) the *umbilical fissure*, which is the anterior portion of the longitudinal fissure and contains the round ligament; (4) the *fissure of the ductus venosus*, constituting the posterior half of the longitudinal fis-

sure, in which are the remains of the ductus venosus; (5) the fissure, or more properly *fossa, in which the gall-bladder* is contained.

The lobes are the *right* and *left*; the *lobulus quadratus*, which is between the longitudinal fissure and the gall-bladder; the *lobulus Spigelii*, between the inferior vena cava and the fissure of the ductus venosus; and, lastly, the *lobulus caudatus*, which is represented by a ridge extending from the base of the lobe of Spigelius to the lower surface of the right lobe.

Physical examination is necessary to a proper estimate of the condition of the liver. A knowledge of the following anatomical facts is essential to its intelligent practice: The right lobe of the liver, which constitutes the bulk of the organ, is separated from the concave lower surface of the right lung by the diaphragm only. It is covered in its upper portion by a thin tongue of lung, and reaches at its highest point to within about an inch of the right nipple, coming into contact with the surface posteriorly at about a line projected laterally from the spine of the tenth dorsal vertebra. A line drawn across the front of the chest, intersecting the lower end of the sternum, indicates with fair accuracy the upper border of the liver and crosses the heart's apex. Considerable displacement of the organ is possible, especially by pressure from above. Beneath, the liver is related to the stomach, colon, duodenum, and right kidney.

The liver possesses a fibrous coat—the *capsule of Glisson*, which invests the entire organ, and at the transverse fissure accompanies the vessels into the interior. The serous coat is reflected over the organ except at its posterior border, and at the point of entrance of the large vessels.

Upon section the division of the entire liver substance into lobules is apparent. They vary from one-tenth to one-twentieth of an inch in diameter and are marked by a light periphery and a darker centre. Connective-tissue cells are found about the lobules, but they are not surrounded as in some animals by a layer of connective tissue. An intralobular vein marks the centre of the lobule and receives the blood from both the hepatic and portal systems.

The hepatic cells rest in a mesh-work of capillaries and gall-ducts, are polyhedral in form, and from $\frac{1}{700}$ to $\frac{1}{1000}$ inch in diameter. Their nuclei are well marked and they contain minute oil-drops.

The gall-ducts originate within the lobules in the form of minute vessels, which unite and ultimately form tubes which are composed of common fibrous and elastic tissues with unstriped muscular fibres, and are lined with columnar epithelium. By their union these ducts form the hepatic duct, which uniting with the ductus choledochus, forms the common duct opening into the duodenum.

Physical Examination of the Liver.—Inspection. This enables us to discover abnormal prominence in the hepatic region. Excepting

sometimes in very small children no prominence in the right hypochondrium is discernible in healthy subjects. When, however, the liver is considerably enlarged there may be a projection below the border of the right ribs. The ribs, as a rule, do not project from this cause, excepting in children whose bones are not yet hardened. It is important to note whether the prominence is situated at or below the ribs, for if the latter only, it suggests displacement rather than enlargement of the liver. If there is prominence, the general contour should be noted, for in cases of tumor where the abdominal walls are thin it may be nodular or local. Sometimes pulsations in the hepatic region may be observed.

Palpation. For the practice of palpation of the liver the patient should lie on his back with the abdominal walls relaxed as thoroughly as possible. Under normal conditions the lower border of the liver corresponds very nearly with the margins of the right lower ribs; hence palpation of the healthy organ is not an easy matter. It may, however, be discovered at the lower border of the ribs on the right mammary line, or in the epigastrium. If, however, the organ is enlarged, and especially if its margin is irregular or distinctly nodulated, it is readily detected by palpatory efforts. A deep inspiration depresses the liver, which may then be felt gliding beneath the finger tips. The manipulations may stimulate the rectus abdominalis muscle to contraction to such an extent as to simulate enlargement of the liver or suggest the presence of a morbid growth in the hepatic region. This phenomenon should not, however, deceive a careful examiner.

Besides locating the lower margin of the liver, palpation should give information as to local tenderness, and in cases of hepatic enlargement, the general character of the surface and consistence of the liver. Tenderness is observed in cancer, abscess, biliary engorgement and the early stages of cirrhosis. It is absent in fatty, amyloid and fully developed cirrhotic liver. It may be present or absent in syphilitic liver or echinococcus.

The substance of the liver is uniformly enlarged, and its surface smooth in hepatic congestion, fatty and amyloid degenerations, and hypertrophy. Inequalities are observed in different varieties of tumors, *e. g.*, carcinoma and echinococcus.

The liver substance is observed to be firmer than normal in hypertrophic cirrhosis, congestion and amyloid degeneration. A sense of fluctuation may be discerned in abscess and echinococcus cysts.

The condition of the gall-bladder is also to be learned by palpation. When normal in size it can rarely be felt. Not so, however, when it is distended. If it is enlarged, an effort to empty it by compression should be made, which can frequently be done in catarrhal jaundice. Attention should be directed to the presence or absence of gall-stones, which may sometimes be felt when the abdominal walls are thin. The fundus

of the gall-bladder lies below the liver at the right border of the rectus muscle, and at about the ninth costal cartilage. The conclusion of the expiratory act is the most favorable moment for the practice of palpation of the liver and gall-bladder.

Percussion. This method of physical examination, when practised with due attention to the avoidance of errors, the nature of which will be explained, affords the most reliable means of determining the size and situation of the liver. It must be remembered that only a portion of the liver comes in contact with the thoracic or abdominal walls, being separated from the former above by lung tissue. The lower edge of the liver dips downwards, and is comparatively thin. Behind it lie stomach and intestines. Over the main portion of the organ, coming in contact with the abdominal walls, percussion gives absolute dulness. Above, where the lung intervenes between the liver and the chest walls, the dulness is decidedly less marked, and the percussion note gives some pulmonary quality. Percussion along the lower border of the liver, when lightly performed, gives the usual hepatic dulness; but when the blows are comparatively strong, the tympanitic quality from the stomach and intestines beneath is added. Remembering these facts it is easy to outline the boundaries of the liver. Percussion, however, may fail to properly represent the upper boundary line of the liver when that organ is covered by emphysematous lung tissue, or the lower boundary when the intestines or peritoneal cavity are distended with gas. The difficulties of investigation are enhanced by the fact that the liver is covered partly by bony walls, *i. e.*, the arch of the ribs, and partly by soft tissues.

In practising percussion of the liver, we first proceed to determine the upper boundary of the organ, percussing lightly or heavily above, and proceeding towards the organ until a point of relative dulness is reached. This should be noted. The examination should be continued until absolute dulness is obtained. Proceeding still further downward we finally come to a point when dulness is again relative, and finally one at which tympanitic resonance is obtainable. The latter marks the lower border of the liver. The breadth of the liver dulness anteriorly is about four inches; posteriorly, about three inches, and laterally about six inches. In health, the upper border of the liver is found at the fifth interspace, posteriorly at the ninth, and in the axillary line at the sixth. The lower line of dulness anteriorly corresponds with the edge of the ribs, although in the aged it may be a finger's breadth or more above. Posteriorly, it merges into the dulness of the renal region. In some persons the lung may cover the liver to such an extent that the width of the area of dulness may be reduced one half. In children, the relatively greater size of the organ accounts for the higher and lower position of the border lines.

As the result of disease the liver may be increased or diminished in size. Increase in size may be general, involving the entire liver uniformly; or local, affecting a limited portion, *e. g.*, a single lobe. The physical evidences of such enlargements may be detected by extension of percussion dulness upward, downward, or in both directions.

General Increase in Size of the Liver. This may be due to hyperæmia, fatty or amyloid disease, carcinoma, and rarely to suppurative hepatitis or hydatids.

Local Enlargements are the result of abscess, cancer or hydatid disease. These conditions often give rise to irregularity in the shape of the liver as well.

Affections most likely to be confounded with liver enlargements are various tumors developing in the abdominal cavity, especially such as are connected with the colon, stomach, kidneys, or ovaries. Diseases of the lungs and pleuræ producing percussion dulness may give rise to the impression that the liver is enlarged. But the history of the case and repeated examinations conducted with due attention to the possible existence of pleural or pulmonary disease, will prevent the error. So far as the actual dulness is concerned, that of pneumonic consolidation and pleural effusion is no different from that over the liver.

Abnormal Position of the Liver. This may be of congenital origin, or it may be due to disease of the vertebræ, rachitis or tight lacing. The formation of sub-diaphragmatic abscess may produce an apparent increase in the size of the organ, which is naturally depressed by the accumulation of pus between it and the diaphragm. The possibility of mistaking a contracted rectus muscle for enlargement of the liver has been referred to.

Tumors of the kidney may simulate enlargement of the liver, but they are movable, usually present rounded edges, and the general kidney outline. Urinary analysis is of assistance in such cases. Fæcal accumulations in the colon may deceive, but can usually be removed promptly by means of a purgative. Effusion into the lesser peritoneal cavity, occupying the upper left quarter of the abdomen, sometimes extends as low as the umbilicus. Such a condition bears some resemblance to disease of the left lobe of the liver, especially to hydatid cysts. Cysts of the pancreas have presented similar resemblances. When ascites is present or there is a collection of pus or other fluid at a point which obscures the diagnosis, it may be necessary to employ the aspirator.

Diminution in the Size of the Liver. Palpation is here of negative value, but percussion demonstrates an elevation of the lower boundary line, which may be several fingers' breadths above the edge of the ribs. Sources of error are distention of the bowels or peritoneum with gas, or the covering of an unusually large portion of the organ by

emphysematous lung tissue. Reduction of the size of the liver occurs in cirrhosis, acute yellow atrophy, and a variety of forms of chronic atrophy.

General Etiology of Diseases of the Liver.—It is worthy of remark that liver diseases, as a rule, are secondary to morbid processes elsewhere, or are the result of definite violation of the laws of hygiene. Investigations, therefore, into the previous history of the case, and a thorough examination of the entire patient afford valuable clinical data. Age is an important etiological factor, because the causes which lead up to hepatic disorders are rarely operative until adult life is well advanced. Young subjects are not, however, exempt, as instanced by the occurrence in them of congestions and syphilitic and amyloid disease. Habits are decidedly productive of disease of the liver. Especially does this remark apply to excessive indulgence in alcoholic beverages, particularly if taken undiluted and without food, in relation to hepatic cirrhosis. The ingestion of excessive quantities of food, especially such as are rich in condiments, exposure to cold, long residence in a hot climate as in tropical countries, and malarial infection, are also important causes.

Functional disturbances are often developed by imprudent eating, and are favored by disturbances of digestion, torpid bowels, etc.

The relation of diseases of the liver to those of other viscera must ever be borne in mind. Congestion of that organ is not an uncommon attendant upon chronic valvular disease of the heart and obstructive lung disease. Abscess may occur as a complication or sequel of dysentery; cirrhosis from various infectious diseases; amyloid disease from syphilis, tuberculosis in other organs, chronic suppuration and bone disease; multiple abscesses, in the course of pyæmia, etc.

Morbid Anatomy of Diseases of the Liver.—The abnormalities to which the liver is liable are malposition, new growths, parasitic affections, hæmorrhage, parenchymatous inflammation (which may terminate in suppuration or necrosis), interstitial inflammation or cirrhosis, enlargement due to albuminoid disease, cancer, fatty changes, etc., atrophy which may develop rapidly as in acute parenchymatous hepatitis or in various chronic changes involving especially the connective tissue of the organ.

Associated with the biliary passages there may be catarrhal inflammation with obstruction and consequent jaundice, biliary concretions which may be found in the gall-bladder, the bile-ducts, or in the substance of the organ. These foreign bodies may excite inflammatory changes with resulting ulceration, etc., or obstruction and jaundice.

Symptoms Suggestive of Disease of the Liver.—The symptoms attendant upon disorders of the liver are those of any primary associated disease, combined with others dependent upon the enlargement of the organ and those resulting from disturbances in the hepatic func-

tions. Subjectively, the patient complains of various morbid sensations and pains referred to the right shoulder and to the region of the liver. The former consists of sense of a weight, throbbing or tenderness; the latter varies greatly in character with the nature of the pathological process. In gall-stone colic, the pain is paroxysmal; in cancer, it is acute and darting; in inflammation, acute and aggravated by pressure and movement. In all cases care must be taken lest hepatic pain be mistaken for that of pleurisy. Jaundice arises from interference with the functions of the organ. This symptom is of sufficient importance to require elaborate consideration in a separate article. Quite a variety of symptoms significant of disordered digestion may also occur, and are produced by obstruction to the portal circulation. These consist of gastro-intestinal catarrh, gastric and intestinal hæmorrhages, hæmorrhoids, dilatation of the abdominal veins, and uterine congestion. Pressure symptoms arise from the mechanical action of the enlarged organ. Lastly there are the general symptoms arising from the malnutrition and toxæmia produced by the hepatic disorder and its associated conditions.

MALFORMATIONS OF THE LIVER.

Malformations of the liver are of rare occurrence and may be either congenital or acquired. The most commonly observed of the former is the lobulated liver produced by syphilitic disease. Pathologically it consists of a chronic interstitial hepatitis, and the attendant symptoms are those of that disease. Sometimes the liver is observed to be of unusual shape, thus it may be quadrangular. Sometimes the left lobe is absent or consists of a long narrow tongue; and sometimes the fissures are found to be of normal depth.

Of the acquired deformities, the so-called *corset liver* is the most common. It is produced by compression of the organ by tight lacing, and is characterized by the presence of a groove or furrow running from side to side on the right lateral and anterior aspects of the organ. This condition is sometimes found in men who are accustomed to keep their trousers in position by wearing a tight belt.

Examination of the tissues about the furrow reveals the existence of a fibrous band, the glandular structure of the liver having disappeared at this point.

Ordinarily, the "corset liver" produces no symptoms directly referable to it. The exceptions are found in cases in which the cicatricial tissue or the pressure obstructs the flow of bile from the gall-bladder and so favors the formation of gall-stones. In certain rare instances described by Strümpell a constant "sensation of pressure and pulling is felt in the hepatic region, and sometimes as a result of venous stasis, there is a temporary but decided swelling of the isolated portion, and

possibly violent pain and indications of irritation of the peritoneum, such as vomiting and an approach to collapse. Usually, rest in bed and cold applications give speedy relief; but relapses are possible."

"Corset liver" is to be recognized by palpation when the abdominal walls are lax, as they generally are in those of advanced years, and in whom this deformity is present. Care must be exercised lest it be mistaken for tumor of the liver.

Another acquired deformity of the liver has been described by Coats. The furrows take a direction from before backwards, and are produced by the pressure of the ribs, as in cases of obstructed respiration and spinal curvature.

MALPOSITIONS OF THE LIVER.

Like malformations, malpositions of the liver may be either congenital or acquired. The congenital consists of lateral transposition of the organ and eventration. In the former the liver is found mainly on the left side; in the latter, some portion of the abdominal walls is deficient. Imperfect development of the diaphragm may exist and results in the escape of a portion of the liver into the chest. With deficiency of the anterior abdominal parietes, the liver is exposed in front. Neither of these conditions is necessarily accompanied by symptoms.

The acquired malpositions of the liver are upward and downward displacements and "wandering liver." The upward may be produced by abdominal tumors, tympanitic distention of the abdomen or ascites; and the downward by pleuritic effusion, intrathoracic tumor, and pulmonary emphysema. These malpositions are of especial importance because of the liability of mistaking them for alterations in the size of the organ. The attending symptoms are those of the primary affection.

"Wandering liver" is a condition hitherto found only in women and is believed to be the result of an abnormally long suspensory ligament. It seems to have been produced by relaxed abdominal walls, tight lacing, and muscular effort. In view, however, of the frequency with which these causes exist and the rarity with which "wandering liver" is observed, Thierfelder doubts that a direct etiological relationship exists between them, believing that a congenital abnormality of the suspensory ligament exists as a predisposing cause.

The extent to which the liver drops from its wonted position varies greatly in different cases. It may be as low as the iliac fossa, while palpation shows a depression between the upper border of the organ and the lower margins of the ribs. Manipulation of the tumor is frequently capable of elevating the organ to its normal position. Winkler and Sutugin were able also to feel the stretched suspensory ligament. It is not a little remarkable that in all the cases reported the liver was found

of normal size and structure. In most of the cases the movable organ changed its location with alterations in the posture of the patient.

This condition is attended by quite a variety of symptoms. Pain and digestive disturbances are prominent features. The tendency of the movable liver to shift under the influence of gravity is the source of considerable discomfort.

The diagnosis of "wandering liver" is made by the discovery in the inferior abdominal region of a tumor having the general contour and size of the liver, while between its upper border and the lower portion of the right lung percussion gives a clear tympanitic note. The diagnosis is positively verified when by manipulation the tumor can be restored to the position of the liver.

The only available treatment is the application of a broad abdominal support so adjusted as to maintain the liver in as near its normal position as possible.

ANÆMIA OF THE LIVER.

Anæmia of the liver cannot be stated to occur as an independent affection, but rather as a part of general anæmia, or secondarily to certain pathological processes such as amyloid or fatty degeneration.

HYPERÆMIA OF THE LIVER.

Both active and passive hyperæmias of the liver are recognized, although the former (fluxion) exists mainly in a theory which admits of an increase of the normal flow of blood to the organ occurring after meals, and which may from excessive feeding become pathological in character.

ACTIVE HYPERÆMIA OF THE LIVER.

This condition is especially favored by indulgence in rich food and alcoholic beverages. Such an active hyperæmia may also arise from vaso-motor influences in association with disorders of the sexual organs or hæmorrhoids. Suppression of menstruation, and according to Frerichs, injuries to the semilunar ganglion, may excite active hyperæmia. The engorgement of the liver which attends malarial poisoning and certain of the specific infectious diseases, is also active in character, and is also the first stage of acute inflammation of the organ. Traumatism may also be a cause, and gastro-intestinal catarrh undoubtedly occasionally gives rise to symptoms stimulating hepatic congestion. The same is true of catarrh of the bile-ducts.

Pathology and Morbid Anatomy.—It is rare that a liver which is the seat of simple active congestion can be examined in that state owing to the rapid disappearance of the hyperæmia, and also because resulting changes are the same in kind as those attending the passive

variety. Some uniform swelling with softening and a darker color of the liver substance constitute the most important pathological features. From distention of the capsule, the organ may be somewhat firmer than in health, but it retains its normal contour.

Symptoms.—These are not characteristic, being similar to or identical with those attending a passive hyperæmia of the liver or gastro-intestinal catarrh.

PASSIVE CONGESTION OF THE LIVER.

By this form of hyperæmia is meant an engorgement of the liver resulting from an obstruction of the flow to blood from the liver and through the hepatic vein and vena cava to the heart. This obstruction may be local, *i. e.*, dependent upon causes acting directly, within the liver, or on the hepatic vein; or general, *i. e.*, obstruction in the circulation at a distance from the organ. Of local causes the most important are pressure upon the branches of the hepatic vein by a tumor, obstruction of this vessel by thrombi, or a hyperæmia of a portion of the liver incident to a constriction, such, for instance, as may result from tight lacing. Of the general factors obstructive disease of the heart is much the most important. Enfeeblement of the myocardium from any cause, valvular lesions not yet compensated or in which compensation has been lost, are the most frequent of all causes. Especially important is dilatation of the right ventricle associated with tricuspid insufficiency, these conditions being secondary to disease of the valves of the left heart.

Of less importance are the various affections of the lungs which cause obstruction in the pulmonary circulation for long periods of time. Of these, special mention may be made of chronic pleurisy, emphysema, asthma, bronchitis, interstitial pneumonia, and atalectasis. Compression of the inferior vena cava by tumors, aneurisms, or inflammatory products, and inflammatory changes about the hepatic vein or obstructions within, are also causes. Angular curvature of the spine may produce hyperæmia of the liver by reason of its influence upon the circulation within the chest.

Pathology and Morbid Anatomy.—The extent of the changes in passive congestion of the liver are dependent in a measure upon the duration of the disease. In the early stages of the affection the organ is uniformly enlarged, smooth and tense, its capsule distended, and its color purplish. The glandular tissue itself is more or less softened, and its cut surface yields considerable blood. It is also somewhat mottled owing to the darker color of the centres of the lobules as contrasted with the surrounding yellowish zones. This peculiar coloration has given the disease one of its designations,—*nutmeg liver*. The explanation of this appearance is found in the fact that the centres of the lobules are occupied by minute branches of the hepatic veins which are dis-

tended. Bile pigment is deposited in the surrounding hepatic cells, which are more or less atrophied by pressure. The light portion of the mottling corresponds to the interlobular veins and are due, according to some authorities, to deposits of fat. The interlobular tissue may be hypertrophied and interspersed with lymphoid bodies.

After a time the enlarged liver dwindles and is ultimately smaller than normal, and may even be reduced to a small indurated organ covered by a roughened, puckered or wrinkled capsule, which has lost its transparency. These changes are attended by similar ones in the kidneys, spleen, pancreas, and intestinal mucous membrane.

Symptomatology.—Mild or recent cases are often unattended by any symptoms directing attention to the liver as a seat of disease. Later, there is a sense of discomfort—it is rarely described as pain—in the hypochondrium, and this is aggravated by the pressure of the clothing and by lying on the left side. In some cases, especially in those of acute character, local tenderness is present. Gastro-intestinal symptoms appear and consist of furred tongue, nausea, vomiting, and bilious diarrhœa or constipation. Sometimes the quality of the bile is altered, for as it passes down the intestinal tract it seems to occasion griping pains.

Jaundice is sometimes present, but is usually of mild grade, being manifested by a slight yellowness of the conjunctivæ and a sallow hue of the face. It is apt to be more marked in instances depending upon cardiac disease, in which case, when cyanosis is present, the combination of pathological discolorations results in a greenish tint of the skin. The stools may present a normal appearance in some cases. In others, in which catarrh of the bile-ducts is associated, they are devoid of bile.

In old cases, especially those arising from long residence in tropical malarious countries, a cachectic appearance supervenes. The patient becomes anæmic; his complexion is sallow; his circulation is poor, as evidenced by coldness of the extremities; his nervous system suffers; he becomes irritable and depressed; and digestive disturbances are marked.

In the later stages of the affection, when the liver has undergone atrophy, ascites may appear.

Physical Examination reveals all the signs of enlarged liver, which in extreme cases may extend to below the umbilicus. The consistence of the liver is considerably increased, and in some old cases may be so great, it is said, as to give rise to the suspicion that the patient is suffering from malignant disease. In cases going on to atrophy the physical signs of that condition are present.

Diagnosis.—The first element in the diagnosis of passive congestion of the liver is the recognition of the presence of one of the causes of that condition. To this is to be added the presence of the signs of hepatic enlargement, such enlargement varying in degree within short

periods. It is furthermore shown to increase with exertion and subside in some measure after rest.

Prognosis.—This depends very largely on the nature of the causative condition, relief of which is necessary to improvement of the hepatic congestion. Acute active hyperæmia of the liver usually disappears on the removal of the exciting causes.

PERIHEPATITIS.

Synonyms.—Subdiaphragmatic abscess; subphrenic pyopneumothorax.

Definition.—Perihepatitis is an inflammation of the peritoneal covering of the liver.

Etiology.—Perihepatitis is practically a secondary affection, either constituting a part of a generalized peritonitis, or the result of some primary lesion in adjacent tissues, *e. g.*, appendicitis. It may occur as an acute suppurative, or as a chronic hyperplastic inflammation.

Acute Suppurative Variety. This may be due to perforation of gastric or duodenal ulcers, certain diseases of the liver, notably abscess, hydatids and affections of the gall-bladder, lesions of the right kidney, or injury to the liver. It generally involves the right lobe of the liver. When the left lobe is affected the trouble is generally due to embolic or traumatic abscess of the spleen.

The acute form may be followed by the Chronic Hyperplastic Variety, which, however, results more frequently from tight lacing, the development of subperitoneal adhesions, gummata, cancer, hydatids, obstruction of the gall-bladder or gall-ducts, chronic pleurisy and certain occupations tending to injurious pressure on the liver.

Pathology and Morbid Anatomy.—Acute Suppurative Perihepatitis. As already stated the right lobe is the one more frequently involved, the inflammation about which may be circumscribed or general. The peritoneal covering becomes inflamed as evidenced by injection, thickening, opacity, and the formation of adhesions between the layer covering the liver and that covering the opposing surface of the diaphragm, with the result of the formation of a sac which may contain as much as several pints of pus. The extent of the adhesions is very variable in different cases. In one of my cases the opposing peritoneal surfaces were completely united, the liver being thus firmly attached to the diaphragm. Such an occurrence, however, is uncommon in the acute variety. Sometimes the contents of the abscess, owing to the admixture of bile, have a yellowish-creamy appearance and contain crystals of bilirubin; they may undergo fatty change, in which case crystals of the fatty acids are found. These characteristics of the pus are of value clinically as affording one means of differentiating subdiaphragmatic abscess and empyema. Pfühl has directed attention to another

point, viz., when tapping an empyema there is an increased spurt of pus during inspiration, while in subdiaphragmatic abscess the same occurs during expiration.

Rupture of the abscess in perihepatitis may take place in different directions with disastrous results, the diaphragm, lung, stomach, colon or peritoneal cavity being perforated.

When the inflammatory process pursues a chronic course, the involved membrane may undergo considerable thickening with more or less extensive adhesions of the opposing layers. Well-defined bands may form between the liver and diaphragm, or between the liver and other neighboring organs. The sclerotic change which follows may result in a contraction of the liver with the development of a lobulated surface. Such contraction, if at the hilus, may be followed by encroachment upon the lumen of the various vessels of the liver, viz., the bile-ducts, portal vein, hepatic vein, etc. The liver may finally become considerably atrophied and assume a spherical outline.

Symptomatology.—In acute perihepatitis the onset of symptoms is usually sudden and severe, and corresponds very closely with the clinical picture presented by an oncoming localized peritonitis. Pain is referred to the right hypochondrium and the epigastrium, may be associated with tenderness, and is aggravated by respiratory movements. The attack is often ushered in by a chill or chills, and repeated rigors often announce the formation of an abscess. The respiration is disturbed, and there may be vomiting and slight jaundice. A prolonged pyrexia of irregular type appears and is suggestive of suppurative action. Should thrombosis of the hepatic vein or of the inferior vena cava take place, dropsy of the legs will develop.

Physical Exploration reveals friction murmurs in the earlier stages of the disease, which, however, soon disappear. In some cases, too, a friction fremitus may be felt. The right hypochondrium is usually distended, and the lower intercostal spaces motionless. The upper line of liver dulness is elevated. The respiratory and voice-sounds are not audible over the dull area. The inferior border of the liver may be much below the line of the ribs.

Course, Termination, etc.—The duration of perihepatitis is exceedingly variable, resolution occurring in some cases within a few days, while those passing on to the stage of suppuration may continue indefinitely, even passing into a chronic stage. The supervention of collapsic symptoms, or of symptoms indicating involvement of neighboring organs through rupture of the abscess, is unfavorable. Even if satisfactory drainage of the abscess is effected, the development of cicatricial tissue may lead to injurious pressure upon important vessels. Union with the diaphragm leads to pain and protracted annoying sensations of dragging, etc.

Diagnosis.—The resemblance of acute perihepatitis to a purulent pleural exudation is considerable, but the absence in perihepatitis of cough, and especially of expectoration, and of displacement of the heart to the left, is sufficient to distinguish between these affections. Again, the degree of downward displacement of the liver is greater in perihepatitis than in pleural accumulations. Rickman J. Godlee, in a recent most able clinical lecture, calls attention to the great height to which the diaphragm may be pushed by the subdiaphragmatic collection of pus, dulness reaching even to the second rib. The aspirator is often necessary to a diagnosis. The best point for puncture is not always the same, but in some instances the seventh or eighth interspace in the lateral region had better be selected. The presence of bile in the evacuated fluid is indicative of an abscess associated with the liver. Loomis states that perihepatitis sometimes resembles intercostal neuralgia, but may be distinguished from the latter by the absence of the tender foci of that affection. From simple pleurisy, perihepatitis is distinguished by the lower situation of the pain, and its increase from upward pressure upon the liver. Pleurisy is attended by more dyspnœa and cough.

Prognosis.—This is governed largely by the nature of the primary affection. In the acute suppurative form, there are the risks attendant upon unfavorably situated rupture, and, in the protracted cases, of atrophy of the liver. Compression of the bile-ducts or of the bloodvessels of this organ may result in atrophy or jaundice.

Treatment.—Rest in recumbency should be advised for the acute cases, and in the chronic form it is a powerful aid. The suffering may be controlled, in some degree, by means of hot fomentations and poultices, which, with a careful selection of medicines, will make the use of opiates but seldom necessary. In the early stage of frank cases, *aconite* may prove of benefit, but must be very soon succeeded by a remedy adapted to the fully-developed inflammatory process, the most important being *bryonia*. This remedy should be continued as long as there is apparent benefit, or, if it fails to control the acute symptoms, *asclepias tuberosa* may be considered. All of these remedies are best administered in the first decimal dilutions, and should be frequently repeated. With the subsidence of acute symptoms, but a tendency to protraction of the disease, *sulphur* should be considered. Occasionally, when there is a tendency to sweats and to pronounced gastro-enteric symptoms, *mercurius* is preferable. In one case, observed by the writer, *chelidonium*, in the second decimal dilution, was promptly successful in controlling the active inflammatory symptoms, the pain was acute, the liver tender, and there was slight jaundice. The attack was due to a combination of malarial poisoning and exposure to severe cold. When the symptoms are very acute, *belladonna* is suggested by severe throbbing pains. Evidences of suppuration suggest *hepar sulphur*, *mercurius*, and

perhaps later, *silicea*. *Rhus tox.* should be considered in traumatic cases, and *iodide of potassium* when syphilis appears to be the cause. The latter medicine may have to be given in quite large doses. *Aurum muriaticum* is also suitable for the specific form. With the development of abscess, the case enters the domain of surgery, and should be promptly submitted to a competent operator.

ACUTE YELLOW ATROPHY OF THE LIVER.

Definition.—Acute yellow atrophy of the liver, also known as malignant jaundice, diffuse parenchymatous hepatitis, etc., is an affection characterized clinically by jaundice, profound toxæmia and malnutrition, and pathologically, by rapid atrophy of the liver associated with other degenerative changes which are especially prominent in the glands, muscles, and epithelium of the internal organs.

Etiology.—The true nature of this affection is still in doubt. Trousseau was inclined to look upon it as an infectious fever, a view that has received some confirmation by recent bacteriological researches (Klebs, Waldeyer), although the micro-organisms discovered have not been found to be pathogenic. Virchow calls it a parenchymatous inflammation.

Acute yellow atrophy of the liver may appear at any time of life, but seems to attack the middle-aged more frequently than others. Women are more often its subjects than are men, the later months of pregnancy furnishing a large share of the victims. Some observers are inclined to attribute all cases to phosphorus poisoning. Other drugs, however, notably alcohol, mercury, arsenic and antimony, have been credited with the power of producing pathological conditions similar to if not identical with that of the disease under consideration. Some cases have appeared to be related to malarial poisoning, syphilis, mental emotions, and certain of the specific infectious diseases, especially typhoid and relapsing fevers, diphtheria, and pyæmia. Notwithstanding the great rarity of this affection,—but a few hundred cases having been recorded in literature,—various observers have met several cases within a period of a few months, experiences which suggest the possibility of an occasional dependence of acute yellow atrophy of the liver upon epidemic influences.

A division of cases into primary and secondary varieties seems to be permissible, the latter, according to Sutton, supervening upon cirrhosis and other chronic diseases of the liver, and especially upon obstruction of the common duct with consequent dilatation of the smaller biliary passages, and destruction of the parenchyma of the liver as the result of pressure. In the primary form the disease cannot be related to any preceding affection.

Pathology and Morbid Anatomy.—Notwithstanding the title by

which this disease is ordinarily known, it is not unusual to find the liver normal in size or even enlarged in the early stages of the affection Later, however, there ensues a rapid diminution in the bulk of the organ, this proceeding to such an extent that it may finally weigh no more than fifteen to twenty ounces. This atrophy is generally described as distributed about equally throughout the entire organ, although the left lobe generally suffers more than any other part. Fitz speaks of the atrophy proceeding in such a way that the liver becomes flattened or cake-like. The general substance of the liver becomes flaccid; the capsule consequently becomes too large and wrinkles. Section of the organ reveals varying degrees of disappearance of structure. The color presented is an ochre-yellow, which, however, is interspersed with areas of a yellow or reddish-yellow, owing to the disappearance of fat and liver cells with the progress of the disease. These reddish patches which represent the most advanced areas of the disease contain many distended bloodvessels. Microscopical examination reveals a loading of the hepatic cells with granules, only a portion of which dissolve in ether. When the cut surface of the liver is exposed to the air for a long time, crystals of leucin and tyrosin appear thereon. The granular cells gradually disintegrate, resulting in a granular detritus containing oil-drops. Similar degenerative changes are found in the muscular tissues, especially that of the heart, and in the epithelium of the stomach and kidneys. The spleen becomes hyperplastic. There are minute hæmorrhages into the tissues. Bleeding into the stomach and intestines also takes place, as evidenced by the dark red or tarry contents of these viscera. Dropsy of the pericardium and pleura may be present, and œdema of the brain and lungs has been frequently observed. The blood is diminished in quantity, and is dark and somewhat fluid.

Symptomatology.—Preceding the development of the disease, there is a prodromal period during which symptoms of gastro-intestinal irritation are prominent. The appetite disappears, nausea is succeeded by vomiting, general weakness, and in some cases by abdominal tenderness and distention. Sometimes jaundice is an early symptom and may precede other evidences of disease for days. It has no special features which enable the physician to differentiate it from jaundice symptomatic of other affections. It first appears in the face and neck, but soon spreads over the entire surface of the body. Sometimes within a few days, or after weeks of continuation of these symptoms, nervous phenomena appear. The patient is now restless and has slight delirium which gradually increases in intensity until it is characterized by violent behavior. It is associated with twitching of muscles, trismus, and convulsions. The development of coma with stertorous respiration indicates the approach of a fatal termination. The early vomiting continues, and later the vomited matters contain blood in masses or in the form of so-

called "coffee-grounds." The tongue is of a grayish or yellowish color, and the teeth and gums may be covered with sordes. Hæmorrhage may also take place from many portions of the mucous membranes, *i. e.*, from the nose, bowels, bladder, uterus, etc. The stools are light in color from deficiency or absence of bile.

The urine undergoes important changes, containing bile pigment and a little albumin. The urea is greatly diminished in quantity and is replaced by elements which, in a later stage of their development, are normally converted into urea. Leucin and tyrosin are present. Their detection is accomplished by the microscope, which exhibits the peculiar crystals in the urinary sediment, or in a drop of urine which has been evaporated almost to dryness. These conditions are strongly corroborative of the doctrine referring the production of urea to the liver.

Fever is usually slight, but a high temperature may be present towards the close of life. Sometimes the temperature is subnormal. The pulse is slow during the first stage, becoming rapid, small and feeble with the progress of the second. The respiration is accelerated and may be noisy during the coma which precedes a fatal termination. Cutaneous ecchymoses and hæmorrhages have been frequently observed.

Physical Signs.—Palpation and percussion reveal in the early stages of some cases the ordinary evidences of enlargement of the liver. Later there appear the signs of atrophy. The first evidence of diminution in size is furnished in the epigastric region, where the liver dulness gives way to tympanitic resonance. Later shrinkage of the right lobe causes the lower edge of the organ to rise from the margin of the ribs, and perhaps to finally disappear entirely, the only dull area remaining being limited to the axillary line. The liver may be tender upon pressure, and the patient may complain of painful sensations. In quite a percentage of cases the evidences of splenic enlargement are present, this organ swelling as the result of the general infection and from obstruction in the portal circulation.

Clinical Course.—In typical cases, two stages may be observed, the first of which is sometimes short or absent. The symptoms of the fully developed disease generally appear with astonishing rapidity. The first stage is represented by febrile and other symptoms of a general character associated with those of gastro-intestinal irritation. These are soon followed by jaundice, which is apt to be referred to a simple catarrhal condition.

The special feature of the second stage is the development of the serious nervous symptoms. The delirium is especially violent, and is soon followed by coma. The cause of these symptoms is not clear. They have been attributed to specific infection by those who hold that the disease is of an infectious nature; while others have suggested their origin in cerebral anæmia, cholæmia, acholia, etc. The jaundice which was

already apparent in the first stage increases in intensity during the second. As to its nature there has been some difference of opinion, but its hepatogenous character, at least in most cases, is assured by the discovery of bile acids in the urine. The conditions which determine the jaundice have not been ascertained with certainty, but as there is no evidence of obstruction of the large ducts it is presumed that there are disorders of the fine biliary passages within the liver.

Diagnosis.—There are some cases in which the diagnosis is difficult even after death. In the early stages the symptoms bear a resemblance to catarrhal jaundice, the true nature of the disease seldom being suspected until the second stage has appeared with its nervous symptoms, marked jaundice, ecchymotic spots upon the skin, the changes in the urine, and atrophy of the liver. In the physical examination of the liver, care must be taken to prevent errors in estimating its size, which may easily occur if the organ is separated from the chest wall by a distended colon. As such a condition can be but temporary, however, repeated examination will enable one to eliminate errors from this source.

The resemblance of acute yellow atrophy of the liver to *phosphorus poisoning* is so great that most careful investigation is sometimes necessary to a differentiation. The history must be considered and phosphorus looked for in the contents of the stomach, and after death, in other organs also. It is claimed that in phosphorus poisoning the liver does not atrophy as rapidly and is more painful than in acute yellow atrophy, that there is in most cases but a small amount of leucin and tyrosin in the urine, and that the nervous symptoms are not of as high a grade, but gastro-enteric symptoms are more pronounced. The diagnosis is not always possible even with the assistance of an autopsy.

Prognosis.—The duration of the disease varies from seven to ten days to six or eight weeks in the protracted cases. A few reported cures are looked upon with suspicion, as the disease is considered incurable.

Treatment.—This must be purely symptomatic, as there is insufficient evidence of the value of any remedy or any method of treatment. The ability of phosphorus to produce a condition which can with difficulty be differentiated from acute yellow atrophy of the liver suggests its possible application. Mackenzie recommends the mineral acids, saline purgation, aconite, and quinine, as having accomplished the most good. Stimulants are sometimes of value for collapsic symptoms, and the asthenia. Cold to the head has been advised.

ABSCESS OF THE LIVER.

Suppuration within the liver may have its starting point in the parenchyma, bloodvessels, or bile-ducts of the organ. Occurring as a primary disease, it is dependent upon local causes, but in the great

majority of cases it is secondary to other affections, especially to ulcerative diseases of the intestines. Several varieties of hepatic abscess have been recognized, the division being based upon etiological considerations. The most important are: (1) tropical abscess; (2) pyæmic abscess; (3) abscesses excited by traumatism.

Etiology.—The causes at work in the production of tropical abscess of the liver have excited considerable discussion. By many, tropical abscess is regarded as an abscess dependent upon dysentery. Usually the abscess is the secondary affection; but cases have been reported in which it was the first to appear, the dysentery occurring later. The severity of the attack of dysentery does not seem to possess any etiological influence, as abscess has been observed to follow both mild and severe cases. Abscess of the liver is especially apt to occur in Europeans who visit the tropics, and who take with them to their new abode their previous bad habits of overeating and drinking. Residence in a malarious district also seems to be an important etiological factor. Predisposing causes are intemperance in food and drink, indolent habits, luxurious living, bad food, exposure to hardships and bad hygiene generally. This form of abscess is not unusual in the Southern States, and has been observed occasionally in cities as far north as Baltimore and Philadelphia. Indeed, recent researches would indicate that the disease is far more frequent in the temperate zone than has hitherto been supposed. Osler reports having seen five cases in his clinic within two years, aud having personal knowledge of three or four others in the city during the same time. This impresses me as in excess of what we see in Philadelphia. Besides dysentery, other intestinal affections, notably ulceration, have been assigned as a cause. Abscess of the liver has been secondary to appendicitis and typhoid fever.

The relationship of the amœba coli to hepatic abscess has been carefully studied by Kartulis, Councilman and Lafleur, who appear to have demonstrated this organism to be an important cause of suppuration within the liver. It is especially interesting to note that the amœba coli may be found in the alvine discharges of persons suffering from abscess of the liver, the patient being free from any manifestation of dysentery, and without a history of a previous attack of that disease.

Pyæmic Abscess. Suppuration which is pyæmic in origin is characterized by multiple purulent foci scattered through the liver and usually associated with similar purulent collections in other portions of the body, *e. g.*, in the lungs (general pyæmia). Should the primary suppuration occur within the portal circuit (local pyæmia), the secondary foci may be confined to the liver. The influence of surgical operations or affections about the rectum in the production of these abscesses must be borne in mind. Traumatism, especially of the hepatic region, is responsible for a few cases. Injuries to distant parts of the body, but

especially of the head, are occasionally noted as causes. The relationship of abscess of the liver to some of these injuries is by no means clear. It is evident, however, that some infectious agent must be at work. Hepatic abscess is especially liable to occur if there is an open wound or an osteomyelitis.

A suppurative hepatitis may be excited by the presence of biliary calculi in the bile-ducts. Even ascarides and other parasites may find their way into these passages, and have thus been known to excite suppuration.

A few cases of the disease under consideration follow upon preexisting affections of the liver, viz., tuberculosis, suppurating echinococcus, etc. In tuberculous cases the infective agent may involve the bile-ducts, with the resulting formation of many purulent foci.

Cancer or ulcer of the duodenum, or of the stomach, may excite inflammation of the peritoneum with resulting adhesion of these organs to the liver, later, setting up suppurative inflammation in that gland.

A variety of foreign bodies such as needles, fish-bones, etc., may penetrate the liver with resulting abscess, pyephlebitis developing should the irritant enter a branch of the portal vein.

It is extremely doubtful if abscess of the liver can ever be an idiopathic affection. Still it is convenient to call those cases whose existence cannot be accounted for by this title. The tropical abscess is single in the majority of the cases. In the minority, two, three or more abscesses may be present. In about two-thirds of the cases, according to Waring, the abscess or abscesses occupy the right lobe, being situated nearer the convex surface of the liver. The collections of pus may be so large as to invade nearly the entire organ, which may contain from three to eight quarts of pus. As much as eighteen pounds have been evacuated. In the case of multiple abscesses some of the lesions may be very minute in size.

Pathology and Morbid Anatomy.—The first change observable in hepatic abscess consists in a number of circular particles greyish yellow or otherwise altered in color surrounded by areas of congestion. These break down, suppurate, and coalesce. The character of the abscess wall depends very much upon the duration of the process, the older it is, the greater the appearance of the limiting membrane. In old abscesses this membrane may assume a density almost as great as that of cartilage. Those which have not advanced to this stage may have irregular ragged walls composed of degenerated liver structure, pus-cells and amœbæ, and present a creamy appearance. External to this necrotic layer the liver is of a reddish-brown or livid color; surrounding this again is a zone of hyperæmic liver tissue. The contents of the abscess may be grayish, creamy, mucoid, or more frequently of a reddish-brown (chocolate) color, and of thick gummy consistence. Sometimes

the pus looks like the so-called laudable pus; and in still other cases (rarely observed however) it is thin, watery and grumous. It contains fat drops, leucocytes, and crystals of bilirubin. The cavity may enlarge by the rupture of small abscesses through the walls of the parent abscess, forming one large cavity with shaggy walls. Portions of necrotic tissue may separate from the walls and be found floating in the purulent accumulation. Abscesses near the surface of the liver may excite a circumscribed perihepatitis with possible adhesions to adjacent organs, thus explaining rupture into the stomach, colon, pelvis of the kidney, etc. Rupture may also take place into the peritoneal cavity setting up a general peritonitis unless the pus is limited by adhesions. Ruptures into the pleural sacs, lungs, portal vein, gall-bladder, the large bile-ducts, the inferior vena cava, or hepatic veins, have all been observed. In very exceptional instance the pus burrows to distant points, such as the axilla, inguinal region, umbilicus, etc. If the abscess does not rupture and life is preserved, encapsulation of the contents takes place, the enclosed pus undergoing various changes such as transformation into a colloid or cheesy mass, or calcification. If the abscess is not too large, a cicatrix with a calcified centre forms. The degree of rigidity of the walls of some abscesses of the liver proves a barrier to healing. Suppuration may be continued for years, the fistulous opening closing and reopening repeatedly.

Pyæmic and Septic Abscesses. Hepatic abscesses of pyæmic origin are multiple and are associated with abscesses of other organs. Scores, nay hundreds, of purulent foci may exist. Following upon traumatism a single abscess of large size may form, but this is probably due to the union of numerous small ones. Minute examination may demonstrate the presence of purulent thrombosis in the branches of the portal vein or purulent accumulations in the distended bile-ducts, the latter change being suggestive of a cholangitis as the primary lesion.

Symptomatology and Clinical Course.—It is not a rare thing for an abscess of the liver of considerable size to remain unsuspected during life, making its presence first known at the time of its rupture and discharge into an adjacent cavity or through a neighboring organ, or at the autopsy. Symptoms sometimes present marked similiarities to certain specific affections, thus making it convenient to describe the following symptomatic groups of cases:

(1) *Typhoid form.* This group is characterized by high fever, delirium, tympanites, enlarged spleen, and not infrequently by roseolous eruption.

(2) *A malarial group,* characterized by paroxysms of intermittent fever, generally quotidian in type. Sometimes an enlarged spleen due to pyæmia coexists.

(3) *The phthisical group,* which is attended by cough, dyspnœa, emaciation, anæmia, night sweats, etc.

In connection with the physical signs and local symptoms calling attention to the liver as the seat of the disease, we have in the temperature range an important indication of the suppurative action progressing in that organ. As already stated, the type of the fever frequently suggests the presence of malarial infection or pulmonary tuberculosis. The height of the temperature range and the seriousness of the attending symptoms, will depend upon the acuteness of the process. If rapid in progress, elevations to 104° to 105°F. may be noted, as opposed to the trifling pyrexia excited by slowly developing or latent abscesses. Apyrexial cases have, however, been observed. The temperature sets the pace for the pulse and respiration unless the liver is sufficiently enlarged to interfere with the action of the heart or lungs, or unless the pleura or the pericardium is inflamed, or the lungs perforated.

Jaundice, which is seldom present, is the result of pressure upon the bile-ducts, or of catarrhal inflammation of the same. Hæmatogenous jaundice may result from general infection, *e. g.*, pyæmia.

Emaciation is often marked. The skin is pale, which, with the superadded jaundice, may give rise to a cachectic appearance. The bowels may be constipated, or loose, with bloody stools.

Most patients complain of painful sensations in the liver region, which may be referred to superficial or deep parts. The pain becomes acute with the involvement of the exterior of the organ. If a sharp perihepatitis develops the pain is like that of pleurisy. The frequent extension of pain to the right shoulder and arm is due to both the shoulder and liver receiving nerves from the fourth cervical. The right rectus muscle is often tense, which has been attributed to inflammation of the peritoneum anteriorly. The spleen may be enlarged, and the physical signs of pulmonary abscess present. Ascites is unusual and is excited by pressure upon the portal vein. Anasarca will result if the inferior vena cava is compressed.

Physical Examination.—Friction sounds and fremitus may be heard and felt if perihepatitis is present. If the liver is much enlarged the right hypochondrium is prominent, the intercostal spaces narrowed, the epigastric veins may be enlarged, and the edge of the organ be often readily palpated. Percussion reveals an increased area of liver dulness, which may be upward or downward, and which is usually higher in front than behind. The upper line of dulness may be as high as the second or third rib anteriorly, is irregular in outline, and often presents a marked upward convexity. Posteriorly dulness may extend well up to the spine of the scapula. Sometimes it is possible, if adhesions are not present, to recognize prominences through the abdominal parietes, or in the intercostal spaces, which move in harmony with the respiratory efforts. Such prominences may fluctuate and are then highly diagnostic. The hepatic region is often tender, particularly within circum-

scribed areas, and pressure upon the liver may excite cough, dyspnœa, or pain in the right shoulder. Collapse of the lung may occur in connection with large abscesses, and is indicated by percussion dulness, increased vocal resonance, bronchial respiration, etc.

Diagnosis.—Abscess of the liver is often an obscure affection and may be overlooked even by excellent clinicians. If a large accumulation of pus has taken place the diagnosis may be easy, especially with the aid of the aspirator. A careful investigation of the patient's history may reveal the pre-existence of dysentery, or residence in a climate favoring hepatic abscess; the occurrence of an injury especially to the liver region; an accumulation of gall-stones, or a suspicion of the same due to an attack of biliary colic.

In cases resembling phthisis the sputum should be examined for bacilli, and when malaria is simulated the blood should be examined for Laveran's organism. Quinine may be tried in the malarial cases if still in doubt. In the typhoid variety the temperature curve, eruption and the specific bacillus of typhoid fever are absent. Both may have enlargement of the spleen. The echinococcus cyst presents resemblances, but is not attended by fever, and is much longer in attaining a large size. The hydatid thrill should be searched for. A small patch of pneumonic crepitus at the base of the lung is mentioned by Manson as a valuable confirmatory sign. Pleural suppuration presents points of similarity, and the aspirator may be necessary to a diagnosis. Abscesses of the abdominal wall do not move with the respiratory efforts as do hepatic enlargements. A distended gall-bladder may be suspected by the location and pyriform shape of the tumor. Suspicious pus should be examined for the amœba coli or for elements suggesting its origin.

In all cases remaining in doubt the use of the aspirator, the patient being anæsthetized, should be considered. Punctures into suspicious regions may be made below the costal cartilages and as high as the seventh intercostal space laterally, or well below the upper dull line, at any point anteriorly, posteriorly, or laterally. If a good-sized needle is used considerable blood may flow. The thickness of the purulent fluid may prevent its flowing through the perforated needle and thus defeat the object of the procedure. Failure to evacuate pus with the needle is, therefore, not evidence of the absence of a purulent collection. In reference to the indications for the use of the aspirator it may be stated that if with physical evidence of enlargement, especially of a portion of the liver, there is a hectic form of fever, and a history of conditions known to precede hepatic suppuration, it is justifiable to make punctures. A knowledge of the anatomy of the part and careful use of antiseptic precautions will prevent any unfavorable results even in punctures of the gall-bladder.

Prognosis.—The percentage of deaths has been more than two-

thirds, while the modern method of early operation and free drainage has reduced the mortality to about one-half. Multiple abscesses are attended by great danger, being usually fatal. This is partly due to the fact that the liver suppuration is only part of a general process. The tropical variety, with its single or limited number of foci of suppuration, offers more hope. A successful evacuation may, however, be followed by gangrene, hæmorrhage, embolism, septicæmia, or peritonitis. Unfavorable sequences developing at a later period are, gradually increasing prostration, emaciation, anæmia, and amyloid degeneration. After the opening of the abscess the progress of the patient may be well judged of by the temperature range, a gradual drop to normal being most favorable. The persistence of hectic is unfavorable. The condition of the walls of the abscess, which can be judged of by the pus, influences the prognosis. The presence of fragments of liver or connective tissue indicates the absence of a limiting membrane, and, consequently, the progressive character of the lesion. Examination for these particles is best conducted by shaking the pus with distilled water containing a few drops of ammonia. If poured into a conical glass the fragments will settle, and can be readily removed with a pipette having a good-sized opening.

Treatment.—In all cases the strength of the patient must be carefully supported by the use of concentrated liquid food and stimulants. Hepatic abscess of pyæmic origin is fatal. The general treatment of this form is the same as for pyæmia without this feature. In any form of abscess of the liver some relief may be obtained from the application of heat either dry or moist. Large poultices which should be applied very hot, over a layer of dry flannel, constitute the best method. The pain may require opiates, but these can be avoided in most instances.

While the medical treatment cannot be stated to be very successful, yet it is probably all that could be expected in view of the nature of the underlying affections. *Bryonia* is of some value in the earlier stages, and when the capsule is involved, but possesses little influence over infective cases tending to rapid formation of pus. Under such circumstances *mercurius* is often indicated by the general symptoms as well as by those of a primary bowel trouble. There is considerable evidence of its value. My personal experience has been with *lachesis* in the lower dilutions. Its applicability to these cases does not require argument. *Arsenite of quinine* exercises considerable influence over the hectic symptoms and must therefore affect the lesion favorably. *Baptisia*, in the tincture, was beneficial in a case dependent upon dysentery attended by the typhoidal symptoms peculiar to this remedy. I have thus far observed little influence from *hepar sulphur*. There seems to be some evidence that *belladonna* is of value in controlling the symptoms of the early stage. It is called for by throbbing pains in the region of the

liver, sensitiveness to touch and especially to motion such as arises from jarring of the bed.

Incision and drainage of the abscess or abscesses is the proper treatment to be adopted when evidences of a purulent accumulation appear. The following rules relating to this subject are given by Sir Joseph Fayrer: (1) In all cases where there is fluctuating tumor, operate at once. (2) Explore with the aspirator in cases where the symptoms of abscess of the liver are present, with a distinct tumor projecting from the normal contour of the liver, or causing bulging at the ribs, though there be no perceptible fluctuation. (3) Explore, when symptoms of abscess coexist with uniform enlargement of the liver, but with no distinct tumor or bulging, if there be any local œdema, obliteration of an intercostal space, or pain localized to one spot when pressure is made upon it, or when the patient takes a full inspiration. (4) Explore where there are no signs of abscess, but where the constitutional symptoms are severe and leave little doubt of its existence. (5) When, from the presence of jaundice or other symptoms, there is reason to fear there are numerous abscesses, it will be better to abstain from any operation.

When employing the aspirator to locate pus a long fine needle should be used, and with antiseptic precautions. The thickness of the pus is often such that it will not flow, but it may be found attached to the canula or trocar, or a few drops within the latter. A point manifesting fluctuation, considerable prominence, and especially œdema, should be selected for puncture. If the puncture is made upon the left side, the point of the trocar should be directed obliquely toward the right to avoid injury of neighboring structures.

CIRRHOSIS OF THE LIVER.

Synonyms.—Chronic interstitial hepatitis; fibrous hepatitis; gin-drinkers' liver; hob-nailed liver; contraction of the liver; hepatic sclerosis.

Definition.—Cirrhosis is a chronic disease of the liver, characterized by reduction in the size of that organ, accompanied by increase in its connective tissue, and the degeneration and disappearance of the parenchymatous elements. The organ is indurated and presents a lobulated surface.

Etiology.—Cirrhosis of the liver is due in the great majority of cases to excessive indulgence in alcoholic beverages, and especially to the drinking of whisky and brandy undiluted and taken between meals. This is accounted for by the fact that the blood furnished the liver is well loaded with the poison. Malt liquors and wines, because of the smaller percentage of alcohol contained in them, possess decidedly less influence in this respect, although when taken in excess they are by no means harmless. Stimulating food in excess, especially that highly

spiced, may also be a cause. Indeed, Budd has attributed the frequency of hepatic cirrhosis in India to this cause mainly. Whether the anatomical changes are the result of the direct influence of alcohol upon the liver elements, or, as some believe, of an indirect action through the agency of morbid products, is as yet uncertain. The fact that experimental efforts for the production of cirrhosis in animals by means of the long-continued administration of alcohol have failed, is counted in support of the latter view, as well as the occurrence of the disease in some persons who have not been addicted to the use of alcoholics. Certain alcohols are especially pernicious; for example, that produced from grain and potatoes, which contains much fusel-oil, seems to be the variety most likely to develop cirrhosis of the liver.

The disease may also appear as the result of the action of numerous infectious processes. Botkin claims a direct etiological influence of cholera and typhus fever in the production of cirrhosis of the liver, and believes that other acute infections may have a like influence. Of the chronic infectious processes, two, malaria and syphilis, may produce cirrhosis of the liver. The former seems to be an especially prolific cause in Italy. Virchow and Frerichs have traced syphilis as a cause in a number of instances. In cases of this character, however, the pathological process is not distributed throughout the entire organ as it is in the case of alcoholic cirrhosis.

Solowieff, as the result of experiments on dogs, suggests that obstruction of the portal vein, when brought about gradually, develops the cirrhotic process. Mechanical irritants, such as particles of coal-dust inhaled by miners, may be carried to the liver and there excite fibrous changes (Welch). According to Eichhorst hepatic cirrhosis may constitute part of a general cardio-vascular change with associated fibrosis of the kidneys. Gout, rachitis, prolonged use of certain drugs, especially phosphorus and arsenic, and ptomaine poisoning, have all been claimed as exciting causes. So far as gout is concerned clinical observations do not establish it as a cause of hepatic cirrhosis, nor is the latter affection frequently attended by the ordinary evidences of the arthritic diathesis.

Men are more frequently attacked than are women. Most cases develop at or after middle life, although children are not infrequently the subjects of this disease. The fœtus even is not exempt, hereditary syphilis being the usual exciting cause. Some cases occur in which the discovery of the cause is impossible.

Pathology and Morbid Anatomy.—Cirrhosis proper must not be confounded with other forms of contraction of the liver, viz., those associated with chronic heart and lung disease, in which the formation of connective tissue, while well marked, is never extreme. The perihepatitis sometimes secondary to protracted venous engorgement of the liver, may lead to such thickening and contraction as to compress the

liver substance with resulting atrophy. This lesion of the capsule may extend to the connective tissue within the organ with great reduction in size, especially of the left lobe, giving to the liver a quadrilateral shape. These cases may be absolutely free from any history of alcoholism or other causes of a true cirrhosis. A simple chronic atrophy characterized by disappearance of the liver substance proper and contraction of the organ may result from occlusion of the common bile-duct by a gall-stone. The contraction is uniform, and the surface of the liver is smooth. It is due to a high degree of fibroid change in the capsule and interlobular connective tissue of the liver.

Tuberculosis involving the peritoneum primarily may extend to the liver with tubercular development in that organ and a stimulation of the connective tissue to overgrowth with the usual subsequent contraction (Goodhart; Brieger).

Coming now to the consideration of the pathology of true cirrhosis of the liver, the question as to whether the primary change is in the connective tissue or in the parenchyma of the organ is still a matter of doubt. There are equally competent authorities arraigned in favor of each view. The predominant opinion is that the disease is an interstitial inflammation, the new tissue undergoing contraction, and through its compressing influence excites degeneration and disappearance of the liver-cells. The less popular explanation is that the degenerative change in the liver-cells is primary, and that with their disappearance newly developed connective tissue appears, and this undergoes contraction.

Whether primary or secondary, the connective tissue changes involve the capsule of Glisson, which covers the liver beneath the peritoneum and passes into its depths with the vessels at the portal fissure. In addition to the disappearance of the liver-cells there is also impairment of the circulation resulting from destruction of bloodvessels by the progressive connective tissue development. The development of a collateral circulation is but imperfectly accomplished, and therefore affords but little relief to the overburdened portal vessels. Some observers, especially Charcot, have classified cirrhosis into several forms, according as the newly developed connective tissue is the result of a stimulus emanating from the bile-ducts (insular cirrhosis), or the development of connective tissue about the veins (annular cirrhosis), or the formation of fibrous tissue about the individual liver-cells (monocellular cirrhosis). While there are strong elements of truth in this classification, it is not considered as exactly representing the facts. The special activity of the pathological process in the interlobular connective tissue leads to early involvement of the portal capillaries, with their progressive destruction. The obstruction in the portal area is increased until the capillaries of the peritoneum and mucous membrane of the gastro-intestinal tract are in such a state of passive congestion that effusion, hæmorrhage and torpid

inflammation result, consequently the prominent symptoms of the disease are ascites, gastro-intestinal catarrh, hæmorrhage, enlargement of the spleen, hæmorrhoids, pelvic congestion, enlarged superficial veins, etc. The microscopical appearances are characteristic. The organ is reduced in size, even to one-third of the normal, and the weight is considerably diminished. The color is a reddish-yellow. The left lobe usually manifests the most marked changes. Adhesions to the neighboring organs are common. The consistency is increased, and the tissue may creak beneath the knife. The surface is nodular, the nodules measuring from a few lines to a half inch or an inch. The capsule is thickened, especially in patches. The gall-bladder contains a little light-colored bile.

In an interesting variety—hypertrophic cirrhosis—the organ is enlarged and shows no tendency to contraction. The induration is not as great as in the atrophic form.

Another variety has been observed in which there is a resemblance to fatty liver. The organ is, however, tough, the exterior is smooth, and the cut surface pale and yellowish and the detail ill-defined.

Symptoms.—The most important symptoms of cirrhosis result from obstruction in the portal circulation, but are not pronounced until the changes in the liver are well established. In the earliest stage certain symptoms attributable to hyperæmia of the liver may develop, such as uneasiness, dragging, etc., in the right hypochondrium, and associated with these there are evidences of gastro-enteric irritability. There is nothing in the manifestations of this period to suggest the true nature of the disease, although it may be suspected if the patient gives a history of abuse of alcohol. In some few cases the early symptoms of the disease may be of a much more obtrusive character and of more rapid onset. Still they are of the same character as those already outlined. The early history of the case, then, suggests the presence of a troublesome gastro-intestinal catarrh, evidence of liver trouble not being manifested until the change in the size of that organ is sufficiently great to indicate a lesion there. Sometimes these early gastro-enteric symptoms are entirely absent; indeed, it is not rare for a cirrhotic liver to be discovered upon post-mortem examination in subjects who had manifested no evidence of cirrhosis, or indeed of any other special ailment during life. The possibility of these gastro-enteric symptoms arising from the hepatic disorder has been seriously questioned, for they may well be due to the alcoholic excesses to which the victims of the disease are addicted.

If physical examinations are carefully practised from the initiation of the malady, it is possible to discover in most instances a primary enlargement of the liver with subsequent diminution in size.

When the connective tissue formation has reached a degree sufficient to obstruct the entrance of blood into the liver by way of the

portal vein, ascites and other symptoms of portal stasis appear. The amount of fluid accumulated is usually large, being limited only by the capacity of the peritoneal cavity. In some of the cases it is the first symptom to attract attention. It may happen that the portal vein becomes obstructed by a thrombus, in which case the accumulation takes place very rapidly. In the majority of instances, however, it is very slow developing, but reaches ultimately as much as several gallons. The abdominal distention is furthermore increased in some instances by the development of gas. Indeed the rapid changes in intra-abdominal pressure so often observed are due to fluctuations in the amount of gas. Still the quantity of fluid will also vary from time to time under the influence of free purgation or loss of blood and after hæmorrhages. The removal of the fluid by tapping is generally followed by rapid reaccumulation. In advanced cases the enlarged abdomen contrasts strongly with the emaciated trunk and limbs.

In the attempts to restore the collateral venous circulation, the abdominal veins, especially those of the right side, dilate. They appear under the skin as large prominent cords. About the umbilicus they may assume the form known as the *caput medusæ*. Varices also form about the gastric end of the œsophagus, and in some cases constitute the cause of hæmatemesis.

As the disease progresses the gastro-intestinal symptoms increase, and hæmorrhages from the stomach and bowels take place. The former is manifested by hæmatemesis. Epistaxis and cutaneous hæmorrhages are also occasional phenomena.

The spleen is generally considerably enlarged. The exceptions are found in those cases in which previous disease has caused great thickening of its capsule or where the organ has previously undergone extensive atrophy.

Jaundice is not a necessary symptom of cirrhosis. In the early stages of the affection it is often a temporary phenomenon, its presence being explained by an associated catarrh of the common duct. It may also be dependent upon cirrhosis from obstruction or a complicating perihepatitis. The skin is nearly always sallow in color, but this must not be mistaken for jaundice.

The stools possess no characteristic features. In some cases their appearance is absolutely normal; in others, they are hard and coated with mucus; sometimes they are abnormally pale from deficiency in bile, even in cases in which jaundice is absent. In the later stages of the disease diarrhœa sometimes sets in, being attributed to the transudation of the ascitic fluid.

Another late symptom is œdema of the lower extremities. This is due to the pressure of the ascitic accumulation upon the inferior vena cava and in conjunction with the altered blood state and enfeeblement of the heart.

The urine is diminished in quantity and its specific gravity increased; it contains the evidence of destruction of red blood-corpuscles. The excess of pigments is demonstrated by the development of a purple color upon the addition of nitric acid. The reaction is strongly acid, and upon cooling a quantity of urates settles. Bile may be present. Slight albuminuria with a few hyaline casts is not unusual, but if nephritis develops the albumin increases and casts indicative of the lesion appear.

Diagnosis.—The obscurity surrounding the early period of the development of cirrhosis has been commented upon, but it may be further added, that the nature of the disease is often unsuspected until the occurrence of ascites, hæmorrhage from the gastro-intestinal mucous membrane, or other symptoms of confirmed cirrhosis appear. A history of intemperance in the use of alcohol or food is strongly suggestive. If the liver is reduced in size, and especially if this is associated with enlargement of the spleen, there can hardly be any question as to the nature of the affection. In the early stage there are certain resemblances to fatty or amyloid liver, but the presence of ascites, which is not a feature of fatty or waxy liver, and a history of the operation of the causes of cirrhosis are strong points in evidence. In the chronic stage there is sometimes difficulty in distinguishing between cirrhosis and various affections of the peritoneum, especially malignant and tubercular disease, but the absence or slight character of the gastric symptoms in peritoneal disease, the presence of abdominal tenderness and of quantities of inflammatory matter in the fluid of peritonitis, that of cirrhosis being albuminous, in connection with the history and physical signs, are usually sufficient for a diagnosis. The presence or not of other cancerous or tubercular foci should be determined. In cancer the liver is tender and pain is aggravated at intervals. Hepatic phlebitis may present a strong similarity to cirrhosis, but the ascitic accumulation takes place much more rapidly in phlebitis, both primarily and after tapping. Jaundice is a prominent symptom. Hypertrophic cirrhosis may resemble cancer, but in the former the stools are bilious, and in the latter clay-colored.

Prognosis.—The prognosis is in general unfavorable. This is particularly true for the reason that most cases are due to the abuse of alcohol, a practice often impossible to overcome. In the early stage, when the symptoms are suggestive of hepatic hyperæmia, a successful result is possible, but unfortunately a diagnosis cannot be made with certainty at this time. After the appearance of ascites, and other evidences of serious portal obstruction, the outlook is unfavorable. There is a close relationship between the rapidity of the development of these symptoms, especially of the ascites, and the danger to life. Free hæmorrhage may seriously impair the strength of the patient and even determine the fatal issue. The duration of the disease is variable and often impossible to determine, due to the advanced period of the disease in which it is

usually first discovered. After the appearance of undoubted evidences life is usually protracted but a few months, the termination being delayed a year or more if the nature of the disease is determined early and suitable treatment adopted. A stay in progress may take place even after the appearance of serious symptoms, the general features improving and the patient being restored for a time to comparative health. Life has been known to be prolonged for several years. Death is the result of asthenia or of some complication, especially pneumonia, pleurisy, acute peritonitis, hæmorrhage, typhoid symptoms, erysipelas, etc.

Treatment.—Alcohol and all articles of food of an irritating character, especially spices, highly seasoned food, coffee, etc., must be stopped. Neither should excessive indulgence in any kind of food be permitted. It is well to limit the amount of starch and sugar taken. Animal food is permissible. A diet exclusively of milk often acts well. If there is difficulty in arresting the use of alcoholics, koumiss will be found to satisfy the craving better that any form of food, but should be gradually changed to plain milk. When the stomach is very irritable, rectal enemata may be often employed with advantage. I have found excellent results from the daily employment of lavage, especially when gastric catarrh was present in an aggravated form. A hot saline solution may be freely used through the tube, followed by the introduction of peptonized milk. A high degree of rest is favorable and should be enjoined as soon as the nature of the case is clear.

In the early stage quite a variety of remedies may be employed according to symptomatic peculiarities. As a class they possess an influence upon hepatic congestion and inflammation. *Nux vomica* may be first selected if not contra-indicated. I have observed excellent results from its employment for the control of the early gastric symptoms. *Arsenicum* may be also given upon its well-known symptoms. Both of these medicines are antagonistic to the bad influence of alcohol. Aside from these medicines indications for *mercurius, lycopodium, cinchona, magnesia muriatica, iris ver., podophyllum* and other remedies may be present, and their use assists in the control of symptoms. The gastric catarrh and flatulency is often materially relieved by *argentum nitricum*, second decimal trituration, five grains before meals. It is well preceded by quantities of hot water or lavage. Every effort should be made for the control of the gastric symptoms, as the impairment of the digestive function undoubtedly leads to the development of morbid products which are irritating to the liver and act as a direct cause of progressive inflammation.

With the advent of ascites and full evidence of cirrhosis, remedies should be preferred which have a known pathological relationship to the liver. Most important of these are *phosphorus, aurum muriaticum* and *iodine*. *Phosphorus* was strongly recommended upon both patho-

logical and clinical grounds by Salzer, of Calcutta, who considers it as possessing great curative power in cirrhosis. His observations have been corroborated. While the author has had favorable experiences with this medicine, his most decided results have been gained from the persistent use of *aurum muriaticum* in the first to the third decimal triturations, prescribed largely upon the ground of its relationship to sclerotic processes. Provings also present many symptoms suggesting its applicability. It is recommended, as well as *iodide of potassium*, for cirrhosis developed in syphilitics. Whether iodide of potash possesses the power over simple cirrhosis which some observers indicate is questionable. Many cases of cure by *mercurius dulcis* have been reported, cases in which the diagnosis seemed established. Sior has recently reported an interesting case of the hypertrophic variety as cured by this remedy.

Purgatives or diuretics may be employed to lessen the portal congestion, and abdominal paracentesis for the removal of the fluid, in cases which have failed to further respond to better methods. Elastic compression after tapping has been recommended to prevent reaccumulation. The treatment of such symptoms as hæmatemesis, diarrhœa and perihepatitis must be upon the general principles laid down in the various sections relating to these affections.

AMYLOID DEGENERATION OF THE LIVER.

Synonyms.—Lardaceous, albuminoid, or waxy liver.

Definition.—Amyloid degeneration of the liver is characterized by the presence of a homogenous, waxy-appearing material, with a resulting painless enlargement of the organ. It is intimately associated with cachectic states, especially protracted suppuration, syphilis and malarial fever.

Etiology.—Little is known regarding the relationship existing between amyloid degeneration and the cachexiæ. Dickinson's theory as to its dependence upon a loss of alkalies in pus is given some credence. The amyloid matter is believed by this authority to be dealkalized fibrin.

Waxy liver occurs in association with pulmonary phthisis, constitutional syphilis, tubercular disease of the bones and joints, rachitis, Bright's disease, malignant affections, as a sequence of infectious fevers, etc. Men are more frequently attacked than women. Hereditary syphilis is responsible for some congenital cases.

Morbid Anatomy.—The liver is enlarged, sometimes enormously so, but preserves its normal shape. The weight is increased in proportion to the enlargement. The lower edge of the liver is frequently felt to be much thickened and rounded. The capsule is tense and presents a smooth bright surface. The color is grayish, often presenting a red-

dish tint. The tissue is firm, brittle, inelastic, gives the impression of great solidity, and pits on pressure. The cut surface has a lardy appearance. The liver is anæmic, and thin sections appear translucent. A watery solution of iodine gives to the amyloid areas a peculiar mahogany-brown color.

Methyl-aniline-violet has of late been used as a test. In the early stage the reaction is limited to the middle zone of the hepatic lobule, which is the area of the hepatic artery. In the development of the process the capillaries are first involved. The liver-cells are infiltrated later and many destroyed, with resulting portal obstruction. The gall-bladder is empty, or contains a small amount of thin bile, which is pale, or it may be greenish and inspissated.

Fatty changes may coexist. Amyloid infiltration not infrequently supervenes upon cirrhosis and syphilis of the liver.

The early changes are detectable only by means of the microscope. The lesion begins in the minute branches of the hepatic artery, gradually involves the vessels, and finally the liver-cells, but not in large number.

The true nature of amyloid matter is still in doubt; it is not even certain whether the material is developed in the organs involved, or is brought to them by the blood current. Amyloid matter is believed to be an albuminoid substance and yields leucin and tyrosin. It differs from other albuminoid substances respecting its response to a variety of tests, as already stated.

The amyloid change is usually widespread, involving not only the liver but the kidneys, spleen, gastro-intestinal tract, and, in lesser degree, other organs.

Symptoms.—The symptoms may often be simply those of enlargement and increased weight of the organ, viz., a sense of weight and dragging in the right hypochondrium. Dropsy appears late. It is questionable as to how far the ascites and the gastro-intestinal disturbances are due to portal obstruction. The patient is generally pale and cachectic. The digestive organs are disordered, as indicated by loss of appetite, nausea, vomiting, eructations, and diarrhœa, but their origin is uncertain, as these symptoms are often due to associated amyloid disease of the intestines. The secretion of bile continues, but the stools are light in color. If the kidneys are involved the urine is profuse, of light color, low specific gravity, contains much albumin and waxy casts.

Diagnosis.—The data upon which a diagnosis is made are (1) a history of conditions known to be favorable to the development of amyloid degeneration; (2) marked enlargement of the liver, which is firm, has a sharp border, and free from pain; (3) a cachectic state with dropsy; (4) evidences of amyloid degeneration in other organs.

From hypertrophic cirrhosis it is distinguished by less resistance, absence of abdominal dropsy, and swelling of the spleen. From leucocy-

thæmia it is distinguished by the absence of an increased number of white blood-corpuscles.

Prognosis.—Amyloid degeneration is a chronic affection, usually existing for a period of many months before its detection. Its duration may be several years, exceptional cases progressing rapidly to a fatal issue. Periods of temporary improvement may occur, but the ultimate result is death. Good observers have believed in its curability in some instances, but there is thus far but meagre evidence to support such a view. Unfortunately it represents a late feature of very serious forms of disease. Death is the result of anæmia, exhaustion, dropsy, or some associated or intercurrent affection. The syphilitic variety is often amenable to treatment.

Treatment.—Failure in the treatment is due to two causes, first, inability to detect the disease until it is well developed; secondly, the serious character and often the incurable nature of the parent affection. Treatment must be directed to the primary disease, as we know of no remedies possessing a specific influence upon amyloid degeneration. When syphilis appears to be the cause, *iodide of potassium*, *aurum muriaticum*, and *mercurius* are the most important; medicines less frequently employed are *nitric acid* and *hepar sulphur*. Old school authorities advise the *iodides*, *iron*, and *iodine springs*, such as Kreuznach and Woodhall Spa.

Ammonium chloride, which has been recommended in large doses, has appeared to exercise a favorable influence in the lower triturations.

Suppurative lesions should be treated surgically in suitable cases. The best of food, fresh air, careful attention to the skin, bowels, etc., are required.

FATTY LIVER.

Etiology.—A fatty accumulation in the liver-cells may be secondary to a degeneration of the protoplasm (*fatty degeneration*); or such a deposit of fat may take place in a cell which is unaltered by disease (*fatty infiltration*). In the former variety the protoplasm has in some degree undergone metamorphosis into fat, with consequent impairment of its functional activity, while in the latter the fat has been transported by the portal vessels of the liver, the hepatic functions being impaired as the result of the physical presence of the excessive amount of fatty matter in the liver-cells.

Fatty liver is, to a limited extent, a relative term, for more or less infiltration of the organ with fat is perfectly consistent with health, and must be regarded as a normal condition. The liver, as is well known, is a natural reservoir for the deposit of an excess of fat.

In simple fatty accumulation, the origin of the fat present is especially the fat and the carbohydrates taken as food, but fatty degeneration in other tissues may furnish the fat which is transported to the liver-

cells. While fats and carbohydrates thus favor the deposition of fat, the same takes place also on strictly albuminous diet, providing the subject takes more food than is required for the maintenance of nutrition, and his habits are such as to prevent the complete oxidation of the fat thus formed. Tissue changes and consequently oxygen supply are favored by an active life, therefore sedentary habits constitute an important cause of fatty infiltration. Warmth diminishes oxidation, and is also a cause of the condition under consideration. We may then consider as prominent causes of fatty liver, the taking of large quantities of food and lazy physical habits. Personal predisposition is an important factor in bringing about this result, for there are many persons who are veritable gormands, and who indulge in insufficient exercise, and yet do not store up fat in the liver. Sometimes the tendency to fatty deposit runs in families. Women are more disposed to the condition than are men; and persons at middle age, than those at other times of life.

Fatty liver is common in wasting diseases, especially in pulmonary phthisis, cancer, chronic dysentery, gastric ulcer, and pernicious and other forms of anæmia. The explanation given for this etiological relation is found in insufficient oxidation of fat, an associated lipæmic or galactæmic state, and the formation of fat from the breaking up of the albumin of the general organism.

Abuse of alcoholic drinks, luxurious habits, and excessive heat, all favor fatty infiltration, whereas, fatty metamorphosis is a feature of serious disease of the liver, notably acute yellow atrophy and phosphorus poisoning. It may also appear during pregnancy or in the early period of infantile life.

Fatty infiltration and fatty degeneration may sometimes be associated in the same case.

Chronic diseases of the lungs and heart, which interfere with a proper supply of oxygen to the blood, favor fatty accumulation, since fat is probably removed from the liver by means of oxidation, the product being excreted in the bile.

The fatty liver is uniformly enlarged. Its size may be doubled. It pits upon pressure, and has smooth rounded edges, is pale, presenting sometimes a bright-yellow or a grayish-yellow color. Groups of congested veins may be seen beneath the smooth capsule. Portions of the organ are light enough to float upon water, indeed the entire organ may do so. The cut surface is greasy and pale, and the lobules appear large and poorly defined. The microscope exhibits the hepatic cells containing large drops of fat (*infiltration*), or numerous small globules of fat (*fatty degeneration*). In the milder cases the fatty appearances are confined to the outer zones of the lobules.

Clinical Course and Symptoms.—Fatty liver is a very chronic condition and cannot be recognized by definite symptoms. A moderate

degree of change does not excite symptoms of any character. Being usually associated with a primary disease, symptoms excited by the fatty change are apt to be obscured by those of the primary affection. Obstruction in the portal circulation, due to the compression of the capillaries of the liver by fat, is the exciting cause of many of the symptoms, but is seldom sufficient to cause hæmorrhage, etc. There are often uneasiness or slight degrees of pain in the right hypochondrium, but positive pain is seldom present. Dyspepsia symptoms are quite constant. There may be vomiting; the bowels may be loose or constipated. The diminution in the quantity of bile results in offensive stools which may be decidedly pale. Jaundice is unusual. There is an absence of abdominal dropsy and enlargement of the spleen. Hæmorrhoids are often present. The breathing may be disturbed by upward pressure upon the diaphragm, which is more apparent after meals.

Fatty accumulations, especially in the subcutaneous connective tissue and in the omentum, are commonly associated. A pale, flabby, waxy, and greasy skin, has been considered as characteristic. Altered sebaceous secretion may cause a peculiar odor. The urine presents nothing notable. Palpation detects the smooth rounded border of the liver, which is generally free from tenderness and which may be found as low as the umbilicus. This finding is corroborated by percussion.

Diagnosis.—A smooth painless enlargement of the liver without deformity of outline or abnormal hardness, tenderness, jaundice, ascites, or swollen spleen, occurring in a person whose habits predispose to obesity, or in the course of a disease in which fatty liver is known to be a frequent complication, is in all probability of this character. From amyloid liver it is to be differentiated by the absence of the history of suppuration and the pale cachectic appearance common to that disease. Fibrous hepatitis has persistent jaundice, enlarged spleen, and ascites, none of which are present in fatty liver.

Prognosis.—Fatty liver is curable if the primary affection is of a nature to admit of great improvement or of recovery. Unfortunately this is not often the case. Its unfavorable influences are manifested especially upon the digestive function and upon the general nutrition, in this manner accelerating a fatal issue.

Treatment.—This is largely dependent upon the character of the underlying affection. When the habits of eating, exercise, etc., are bad they must be corrected Fat and fat-producing elements—starch and sugar—must be excluded from the dietary. The largest amount of oxygen possible for the patient to secure is necessary, this being best accomplished by following an outdoor life, also, as much exercise as can be taken without detriment to the general condition is desirable. Too rigid a dietary and overexertion must be avoided in phthisis and other wasting diseases.

Medicines are seldom selected with reference to the fatty change in the liver, but rather to the general state. Probably the most important medicine for the fatty liver is *phosphorus*. Bayes claimed positive results from its use, and my own experience corroborates his observations. It should be given in very small doses. I have had favorable results from *antimonium crudum* when its characteristic gastric symptoms were present. Buchman has reported a favorable result from *chelidonium*. The gastro-intestinal symptoms are to be treated as advised in sections upon gastric and intestinal catarrh, dyspepsia, etc.

APOPLEXY OF THE LIVER.

This rare affection may result from violence to the region of the liver, and has been reported as occurring in new-born infants, presumably the result of traumatism during labor. In southern climates, especially in malarious regions, it has been met as a consequence of intense hyperæmia of the liver, and associated with a variety of lesions. A few cases cannot be accounted for. The hæmorrhage may take place at numerous points, or an extensive extravasation may develop, the hepatic tissue being converted into a diffluent, dark, reddish, or blackish mass. The character of the attending symptoms depends upon the extent of the hæmorrhage. Undoubtedly, many cases of slight hæmorrhage do not develop serious symptoms and are undiscovered. Pain in the region of the liver more or less rapidly developed and varying in intensity, tenderness, gastric irritability, and jaundice, are usually present. Black vomit and stools containing blood (melæna) may attend the more serious cases. If the hæmorrhage is sufficiently profuse, and also in part from the shock of the rapid destruction of the liver structure, the symptoms of collapse may be superadded. The prognosis is most unfavorable, especially if melæna and collapse attend.

The treatment must be upon general indications, as we have not sufficient experience to permit of specific statements.

MORBID GROWTHS OF THE LIVER.

Morbid growths of the liver may be either benign or malignant. The latter, though rare, are the more common of the two, and include carcinomatous and sarcomatous growths. The former are found in greater variety and may be cystic, angiomatous, dermoid, tuberculous, lymphatic, or syphilitic.

CANCER OF THE LIVER.

The malignant growths may best be considered under the general term "cancer." In the majority of cases they are secondary to similar tumors elsewhere. Carcinoma is the more frequently observed variety.

Sarcoma is especially liable to be a secondary growth, the primary formation of this variety of tumor in the liver being very rare.

Etiology.—Most cases of cancer of the liver develop in middle or advanced life, although the disease has been observed in the young, even in infants. Women furnish by far the largest number of cases of secondary cancerous deposit, owing to the frequency with which they are attacked by malignant growths of the breast and uterus. Still the greater number of cases of secondary cancer of the liver follow upon primary disease of the stomach, uterus, and other parts closely related to the liver by the portal circulation. Cancer of distant parts, such as the breast, central nervous system, eyes, etc., may be followed by deposits in the liver. Bartholow looks upon heredity as an important etiological factor, claiming that from 15 to 20 per cent. of cases arise from transmitted predisposition.

Pathology and Morbid Anatomy.—Cancer of the liver, whether primary or secondary, may occur in the form of multiple nodules extensively distributed throughout the substance of the organ, or of a general infiltration. The former is the more frequently observed. The nodules vary greatly in number in different cases, there sometimes being but three or four, while in others there are several hundreds. They likewise vary in consistency, sometimes being hard, and sometimes soft. These variations seem to be dependent upon the relative proportions of fibrous structures, cells and vessels entering into the composition of the growth. The size of the nodules ranges from that of a pin-head to one almost as large as the liver can accommodate. As a rule, the greater the number, the smaller their size, and *vice versa*. The disseminated or nodular variety of cancer is particularly apt to follow upon cancer of the stomach, because the disease is transmitted throughout the entire organ by the portal vein. While the nodes may be either soft or hard, the former condition usually obtains, because the cellular structures predominate. Besides this their centres undergo a destructive degeneration with a resulting cyst (cystic cancer). Fatty degeneration in the centres of the nodules, with surrounding connective tissue formation, according to Virchow, results in absorption, contraction, and subsequent umbilication of the nodules. On inspection they are found to be globular in form, and on section, grayish, reddish-gray or white in color. Sometimes, by reason of pigmentary changes (as in melanotic sarcoma), they are dirty gray or even black. Secondary changes, as fatty degeneration and necrosis, may also take place and impart their features to the tumors. Cancerous growths of the liver are sometimes exceedingly vascular, giving to them a reddish color, and leading not infrequently to hæmorrhage into their substance, followed by pigmentation. They may also be stained yellow by the bile.

The capsule covering new growths involving the surface of the

organ is opaque and undergoes thickening, and often forms adhesions to adjoining structures. The individual nodules are sometimes surrounded by a capsule.

In primary cancer of the liver, the new growth may appear at multiple foci, those of earliest development bearing evidences of greater age and being of larger size. In other cases the disease appears as one large tumor or as a general infiltration of the organ. Primary cancer of the liver may be engrafted on an already existing cirrhosis, in which case the organ may be but little above the normal in size. Sometimes the lesions are so situated as to compress the bile-ducts or invade the portal and hepatic vessels. Under such circumstances, jaundice is present, and there are all the symptoms of portal obstruction.

The liver is usually enormously enlarged. Indeed there is no form of abdominal growth which may attain greater size than the one under consideration. The growth of the tumor is at the expense of the cellular liver structure. In the infiltrating variety, the enlargement is uniform in all directions. The color of the liver in section is somewhat paler than normal, excepting in the melanotic variety, which presents a granite-like appearance.

The minute structure of hepatic cancer presents no essential variation from that of cancerous growths in other parts. The soft or medullary variety is more frequent than the hard or scirrhous. The origin of the primary growth is the epithelium lining the biliary canals, but some pathologists believe that the liver-cells also proliferate. The connective tissue variety develops from the connective tissue of the region, and also from the capillaries (Naunyn).

The white blood-corpuscles are sometimes increased in number, and the red diminished, pale, and presenting abnormalities in shape.

Clinical Course.—As in most instances cancer of the liver occurs secondarily to cancer in other portions of the body, it is attended by conditions clearly indicating the nature of the disease. In others the prominence of the primary lesion, or the smallness of the hepatic development, may cause the latter to be overlooked, it being often first discovered at the autopsy. The symptoms developed by the hepatic growth are often intimately associated with those developed by a primary lesion. The duration cannot be stated definitely on account of our inability to determine the time of commencement, but it is seldom that life is prolonged for more than six months after a positive diagnosis is possible. In one of my own cases, occurring in a woman of sixty-four years of age, the enlarged liver with clearly distinguishable nodules upon its surfaces existed for about one year before death. Compression of the bile-ducts by the cancerous mass or by degenerative lymph glands results in jaundice. The portal and hepatic vessels may be invaded by a soft growth, and the gall-bladder is frequently the seat of a secondary development.

Terminations within two or three months are observed, the symptoms simulating an inflammatory affection of the organ.

Death is the result of increasing prostration, which is contributed to by ascites, hydrothorax, peritonitis, bronchitis, pneumonia, etc.

Symptomatology.—In the early stages of the disease the symptoms are exceedingly obscure. The patient is gloomy and despondent, and complains of a sense of discomfort in the hepatic region. In the case of primary cancer much importance is not attached to these phenomena, consequently their true significance is hardly suspected. When due to secondary disease they are frequently overshadowed by the symptoms of the primary tumor.

When the tumor is of small size, or is so located as to excite neither functional trouble nor exert pressure upon adjacent organs, the first symptoms experienced are those of a general character only, viz., loss of strength and flesh, some pain, which may be referred to the hepatic region or to the back, abdomen or extremities. These symptoms are not infrequently attended by gastric disturbance and constipation. A cachectic appearance which is suggestive of malignant disease, but not of its location, may also develop.

As the disease progresses evidences of enlargement of the liver appear. As already stated, the increase in the size of the liver is truly enormous. It is not unusual for that organ, when affected by cancer, to weigh ten or twelve pounds, and twenty to twenty-five pounds have been frequently reported. In well-marked cases the growth distends the entire abdominal cavity, the special prominence being in the hepatic region. In thin persons it is sometimes possible to discover by palpation the depressed centres of the cancerous nodules, which are found to move beneath the examining fingers with the movements of respiration. Percussion sometimes reveals an increased area of dulness extending to beneath the iliac crest. When the disease involves the left lobe of the liver, the aortic pulsations may be felt so distinctly as to give the impression that possibly an aneurism of the abdominal aorta exists. A distinction is readily made, however, because of the absence of distensile pulsations.

Pain is usually present and may be confined to the region of the liver, or it may radiate to the right shoulder and arm, or to portions of the back. In some cases it may be developed only on pressure. Sometimes it appears in sharp attacks of limited duration, in which case it suggests the presence of a circumscribed perihepatitis.

Jaundice occurs in nearly one-half of all cases. It varies in degree from the slightest yellowish tint to the most profound discoloration. It is attended by pale stools and other of the conditions incident to jaundice. The skin may be of a decided green tint; or again it may have a bronzed appearance. Ascites is a late development of many cases and is due to

involvement of the branches of the portal vein or to compression of the vena cava. Peritonitis may develop as a result of the extension to the peritoneum or in consequence of the rupture of a cancerous cyst into the peritoneal cavity. If there is a sufficient degree of obstruction of the portal circulation the superficial abdominal veins may enlarge. The spleen is generally normal in size; but it may be enlarged. Hæmorrhages may occur from any of the mucous membranes or the skin. Itching of the skin is common and is usually due to the jaundice.

Fever is seldom present, and is then due to some complication. The temperature may be subnormal, or less frequently a high temperature may develop before the fatal termination. The pulse becomes weaker and more rapid with the progress of the disease. Symptoms resembling acute yellow atrophy are occasionally developed late in the course of cancer.

The urine is usually scanty and often exhibits a trace of albumin. Indican may be increased, and the urine much darker in color than normal. It may even be black from the presence of melanin or melanogen in cases of melanotic cancer or sarcoma of the melanotic variety.

Diagnosis.—The greatest difficulty in diagnosis develops in cases in which the lesion does not enlarge the liver sufficiently to permit of the detection of an enlarged and irregular organ, but symptoms attracting attention to the liver should always be regarded with suspicion, if there is a malignant growth in some other region of the body. The influence of age, sex, and heredity, should be considered. Jaundice may be the only symptom of consequence present, but the greatest degree of enlargement may exist, without jaundice. Enlargement of the gall-bladder may give rise to an irregular tumor, but its location and pear-shape will suggest its nature. From tumors of neighboring organs, those of the liver may be distinguished particularly by their movement during respiration. Amyloid and cirrhotic livers present similarities, but are affections of longer duration.

A history of protracted suppuration or of syphilis suggests the enlarged liver to be amyloid in nature, and alcoholism points to cirrhosis. In these affections there is also an absence of a cachectic appearance and the spleen is enlarged. When jaundice is absent and ascites present, the similarity to cirrhosis is often great, but in cancer the pain and failure of health are more pronounced features. Syphilitic disease of the liver may also simulate cancer by exciting contraction and consequent ascites, also by the development of nodules giving a roughened surface to the organ.

Gall-stones or a catarrhal process may obstruct the gall-ducts with enlargement of the liver. But in these affections the development is rapid, there is usually more of gastric disturbance, the enlargement is smooth, and there is neither ascites nor general dropsy.

Aneurism of the aorta may be suspected when the left lobe is en-

larged and transmits the pulsations of that vessel, but the pulsation is not expansile.

Multilocular echinococci are rare; they fluctuate, and are attended by enlargement of the spleen.

Advanced age, rapid loss of flesh, tenderness, jaundice and ascites, one or both, are, in connection with the physical signs of enlargement and irregularity of surface, quite conclusive evidence of cancer; but a positive diagnosis of cancer should be avoided until the symptoms are of a most conclusive character, and even then an opinion had better be withheld, out of kindness to the patient, unless forced to an expression.

Prognosis.—As far as known the disease is invariably fatal.

Treatment.—This is symptomatic only. For indications, both general and medicinal, the reader is referred to the various sections treating of the diseases of the liver, stomach and related organs.

LESS COMMON NEOPLASMS.

It is only possible to notice a variety of morbid growths which appear in the liver, but which are of little clinical consequence on account of their rarity, and also for the reason that it is impossible to determine their nature except at the post-mortem table. Sarcoma usually appears secondarily to primary growths in other organs. It is seldom primary. The secondary variety appears as small nodules, except in that form known as melano-sarcoma. In rare instances sarcomatous growths attain a large size. In one of the author's cases the liver weighed nearly ten pounds.

The lesions of leucocythæmia and of Hodgkin's disease may appear in the liver as numerous small foci. Their large number may lead to enlargement of the organ.

Syphilitic gummata also appear as nodules of various size, and in certain cases develop an irregular surface of the organ, thus simulating carcinoma.

Angiomata are rare and appear as small bluish areas which may in some instances be clearly circumscribed. They consist of communicating passages filled with blood which are supposed to have their origin in the capillaries of the liver. They are without clinical significance.

Fibromata, gliomata, lipomata, myxomata, and neuromata have all beenobserved in the liver.

Parasitic affections of the liver are considered in the section devoted to the subject of the parasites of the body.

JAUNDICE.

Synonym.—Icterus.

Definition.—Jaundice is a morbid condition represented by a yellow staining of the various fluids and tissues of the body.

Etiology.—Two varieties of jaundice have been recognized, the *hepatogenous* and *hæmatogenous.*

Hepatogenous jaundice is due to a variety of conditions involving the liver or the liver indirectly through related organs. The result of the action of these several causes is obstruction to the outflow of bile from the liver, the retained secretion undergoing absorption. Of causes of obstruction immediately associated with the liver the most important are catarrhal inflammation of the bile-ducts, developed by extension from the duodenum, or excited by the presence of biliary calculi, or other foreign bodies. Obstruction is also due to pressure upon the ducts by a variety of lesions and neoplasms. Most important of these may be enumerated morbid growths within the liver, especially carcinoma, aneurism of the aorta, mesenteric or hepatic arteries; new growths involving the pancreas, gall-bladder, colon, duodenum, omentum, abdominal lymphatics, kidney or generative apparatus; and new growths of a parasitic character, especially those due to the tænia echinococcus.

The dependence of jaundice upon a suppression of secretion, which was advocated by Budd, does not seem to be substantiated, Stein having entirely obstructed the flow of blood to the liver without resulting jaundice.

Hæmatogenous jaundice occurs in a variety of affections characterized by excessive destruction of the blood, notably yellow fever, malarial affections, typhoid fever, scarlet fever, septicæmia, various forms of anæmia, and icterus neonatorum. It may result also from the action of certain poisons, notably phosphorus, arsenic, mercury, copper, chlorate of potash, chloral, chloroform and ether. This form of jaundice also follows upon snake-bites, and disorders of innervation affecting the normal metamorphosis of bile, especially fright, violent mental exercises, injuries to the brain, etc.

There is a tendency to exclude the hæmatogenous variety of jaundice, classing all cases as hepatogenous, but evidence in support of this view is not yet conclusive. Ponfick's experiments which resulted in the development of jaundice upon the liberation of a certain amount of hæmoglobin of the blood corpuscles have been antagonized, especially by Stadelmann, who asserts the existence of the hepatogenous variety only, claiming that in Ponfick's cases the jaundice was due to obstruction of the small bile-ducts by catarrhal matter or thickened bile, or their compression by infiltrated interstitial tissue or swollen hepatic cells, these changes being the result of the method employed. This view is supported by the presence of bile acids in the urine.

Morbid Anatomy.—All the tissues of the body undergo staining with the exception of cartilage, the teeth, and nervous tissue. It is most conspicuous in the mucous membranes and skin. The color

varies from pale yellow to a deep yellowish-brown. The intensity of the coloring depends upon the amount of bile in the tissues, this is greater the longer the duration and the greater the degree of the obstruction. The various fluids of the body are bile-stained, with the exception of the saliva, lachrymal fluid, and mucus. The urine forms an excellent guide to the increase and decrease of the bile in the tissues.

An examination of the liver demonstrates extensive staining of this tissue; the individual hepatic cells containing granular masses of pigment of considerable size. The obstructed bile-ducts contain strings of inspissated bile. They may also contain plugs of mucus, and present the various appearances of catarrhal inflammation in its several stages. In order to determine the seat of the obstruction it is necessary to begin at the outlet of the ductus communis in the duodenum, following the biliary tree in its division into smaller and smaller ducts until, if necessary, the microscope is employed. According to the cause of the jaundice some one or more of the etiological factors mentioned will be found present.

Symptoms.—The period elapsing between the development of obstruction and the appearances of appreciable staining of the surface depends upon the degree of obstruction and especially upon the rapidity of its development. It varies ordinarily from two to four days. If carefully sought for, the yellow tint is first distinctly visible in the conjunctivæ. The intensity of the coloring is very variable, and may fluctuate without diminution of the obstruction, which is due to a difference in the rate of development of bile from day to day, and as well as to the rapidity of excretion by the kidneys. Enough bile may be eliminated by the cutaneous glands to lead to a yellow staining of the clothing. It has been found in all secretions. The color of the skin is influenced by the condition of the circulation of the blood in the surface, imperfectly oxidized blood adding a livid tint to the yellow. A bronze appearance is not rare. The complexion, the age and the amount of adipose tissue, all influence the color. The urine also gives early evidence of jaundice, quickly acquiring a yellow color, and is very frothy, the froth also presenting a yellowish tint. The urine is in general normal, but may contain renal epithelium stained with bile, and casts of the hyaline variety. The color of the urine varies from yellowish to greenish, or brownish-black, according to the amount of contained pigment. A yellowish tint is present before it is visible in the surface of the body, and in rare cases the entire amount of bile is excreted by the urine, the tissues remaining free; while in others the tissues may retain the coloring matter for quite a period subsequent to its disappearance from the urine.

The biliary coloring matters are particularly bilirubin and its derivatives by oxidation, viz., biliverdin and bilifuscin. The tests which have proven most satisfactory are Gmelin's, Heller's and Marechalt's.

Gmelin's Nitric Acid Test. This test is based upon the oxidation of bilirubin by impure nitric acid. Place a quantity of urine in a test-tube and allow a small quantity of fuming nitric acid to trickle slowly down the side of the test-tube and accumulate beneath the urine. At the point of contact, if bile is present, there is soon developed a typical play of colors, which should be green, blue, violet, red and yellow or yellowish-green, developing in the order stated. This order is not always followed, however, one or more of the colors failing to appear. Green is the most important and must be present in order to demonstrate the presence of bile. A shading into red and yellow is very common. All the other colors are developed by indican and other urinary coloring matters.

This test has been variously modified and may be conveniently employed by placing a few drops of urine upon a porcelain plate near a similar quantity of the acid. When allowed to approach each other the same play of colors is observed.

Heller's Test. Into a test-tube containing about a drachm of hydrochloric acid add enough urine drop by drop to impart a slight color to the acid. Shake and underlie with nitric acid and as in the previous test an attractive play of colors takes place. If at this stage the nitric acid is stirred with a glass rod the strata of colors which were placed one above the other now involve the whole mixture, but are arranged beside each other and are easily studied by transmitted light.

Marechalt's Test. Place in a test-tube a quantity of urine and permit the tincture of iodine to fall upon it carefully drop by drop. If bile pigments are present a green color appears at the line of contact. This color may remain for many hours.

The presence of bile in the urine in small quantity is suggested by the yellow color of blotting-paper which has been moistened in the urine and allowed to dry.

It is important that the urine tested should be fresh.

The digestive organs are usually disturbed, many of the symptoms being due to an accompanying catarrh of the stomach and duodenum, and others to the absence of bile in the intestines, the loss of the stimulating and antiseptic power of which results in constipation, fermentation, accumulation of gas, colicky pain and offensive passages. The stools are of a light drab color, and contain fat, which should have been acted upon by the bile. They may be dark in color as the result of intestinal hæmorrhage. When putrefactive changes reach a sufficient degree, diarrhœa may develop. The inability of the patient to digest fat leads to impaired nutrition and gradual but constant loss of weight. Other causes, however, operate to cause progressive loss of weight and debility. The appetite is usually poor, the tongue coated, the breath offensive and the taste bitter, due probably to taurocholic acid. Symptoms related to the skin are quite constant, especially itching, which is not attended by

eruptive phenomena and causes great annoyance, especially at night. That it is probably not due to the action of bile pigment upon the skin is shown by its appearance in some cases before the jaundice, its fluctuations during its course, and its entire absence in other cases.

Eruptive features, especially urticaria, boils, carbuncles, herpes and lichen are not uncommon. Scratching may cause various lesions.

Hemeralopia or nyctalopia may be present. Xanthopsy (yellow vision) is a rare and interesting symptom, but does not appear to be due to tinging of the structures with bile pigment.

Hæmorrhages into the skin and from the mucous membrane sometimes occur. It has been observed, especially in jaundice associated with cerebral symptoms and without obstruction of the bile-ducts, but is also a feature of chronic obstructive forms. The pulse, in most cases, is reduced somewhat in frequency; a pulse-rate of 60 is common, and one of 30, or even 20, has been observed. Slowness of pulse may be associated with disturbance of rhythm. These pulse features are common to catarrhal jaundice and consequently are not of evil omen. Bearing upon the causation of this symptom are the experiments of Legg, supposed to demonstrate that the slowness of the pulse in jaundice is due to the action of cholic acid upon the cardiac ganglia; also those of Röhrig showing the influence of the biliary acid salts in retarding and enfeebling the heart, while bile pigments were found to be incapable of exerting any degree of such influence.

Unless jaundice is associated with some condition exciting fever, the temperature will not be above normal. Respiration is seldom altered.

Jaundiced persons are often irritable or depressed. This is not so apparent in cases due to obstruction. Grave nervous symptoms often appear and may constitute simply a feature of the typhoid state, viz., delirium, stupor or actual coma, muscular tremor, subsultus, convulsions, a dry and brown tongue, increasing prostration and loss of control of the sphincters. The absence of a lesion in the brain sufficient to account for these symptoms indicates their dependence upon toxic properties of the blood. The inability of experimenters to demonstrate the poisonous character of bile pigments prevents our ascribing these symptoms to such a source. Whether, as Austin Flint, Jr., suggests, they are due to retained cholesterin, or to an arrest of the liver in its function of reducing albuminous matter to simpler substances, viz., urea and uric acid, the consequent diminished excretion of urea by the kidneys, and the accumulation in the blood and tissues of less oxidized substances, such as leucin and tyrosin, we do not know, but the latter appears the more probable explanation.

Complications and Sequelæ.—Inflammatory complications are quite common and should be watched for, the temperature being taken regularly and physical examinations made. The temperature, however,

may not be raised in inflammation of mucous membranes and it is easy to overlook slight physical signs. The development of acute yellow atrophy may follow upon a case of slight intensity. After months of obstruction and resulting compression of the hepatic parenchyma by thickened bile, especially in subjects of alcoholism, the liver substance will have undergone considerable destruction with a tendency to the development of similar symptoms, viz., delirium, asthenia, coma, death.

Diagnosis.—The evidence afforded by the skin and the urine are sufficient for a diagnosis; the nitric acid tests being employed if any doubt exists. Acute jaundice presenting no complications is usually of catarrhal origin. If following upon an attack of pain and lasting but for a limited time, it is probably due to the passage of a biliary calculus. Recurrences establish the diagnosis. If the common duct is not obstructed the stools will contain bile. The simplest evidence of its absence is light-colored stools. In order to avoid error, it is necessary to bear in mind that a jaundiced appearance is often well marked for some time subsequent to the removal of obstruction and the reappearance of bile in the stools, also that altered blood may give to the stools the appearance of containing bile. Certain drugs, especially iron, give the same result. The degree of obstruction may not be sufficient to completely cut off the flow of bile, consequently the stools may possess a fair color and yet the patient be jaundiced. If with stools of normal color an enlarged gall-bladder is present, the point of obstruction is probably in the cystic duct. If the stools are pale and the gall-bladder cannot be felt, the hepatic system of ducts is obstructed. The greater the absence of bile from the stools and the more rapid in development and intense in degree the jaundice, the more likely is it that the obstruction is external to the liver. Persistent jaundice of slight intensity suggests cirrhosis, passive hyperæmia or malignant disease. In the latter a nodule of the new growth may exert such a degree of compression as to develop intense jaundice rapidly, even in the early stage of the disease. In passive hyperæmia a valvular disease of the heart usually coexists, and in cancer a cachectic appearance will be added to the simple yellowish tint, and probably ascites. In the form called hæmatogenous the urine, if colored, will be found to contain blood pigment, and there will be an abundance of bile in the stools. The cause can usually be determined; there is also an absence of the general symptoms of the hepatic variety.

Prognosis.—It is apparent that the seriousness of any case of jaundice will depend largely upon its cause, and next upon its persistence. In acute catarrhal jaundice the urine begins to clear in from four to six weeks and often exhibits a trace of bile after the appearances of jaundice have disappeared. In other cases the conjunctivæ may be distinctly colored for a week or two after the urine fails to respond to the nitric acid test. Imprudence in diet and exercise favors a relapse. The probability of acute

yellow atrophy must be considered. In chronic cases the prognosis will depend upon the nature of the affection exciting the jaundice. Reduction in the size of the liver, hæmorrhages, disorders of vision, nervous symptoms, and a high temperature, are all indications of a grave condition.

Treatment.—The essential treatment of jaundice must be directed to the control and final removal of the condition causing the obstruction. As this is often of an incurable character, the attending jaundice cannot be removed. In most instances we have seen that the cause is a swollen catarrhal mucous membrane with a secretion of viscid matter which still further obstructs the lumen of the bile-ducts. Such a lesion may be limited to the duodenal end of the common duct or extend to the smaller tubes. If the obstruction is due to a gall-stone it may become necessary to employ surgical measures for relief.

In acute cases the patient should be put at rest in bed, and upon a diet suited to an absence of bile and to a catarrhal condition of the stomach and duodenum; it should therefore be mild and unirritating in character, and given in small quantities at short intervals. Fats should be prohibited, and it is best to give sparingly of starch and sweets. If milk is employed it should be skimmed. Buttermilk often answers well. Very tender meat is admissible as well as some other articles of solid food, if catarrhal symptoms do not contra-indicate, especially eggs, easily digested vegetables, and well-cooked fruits. Water may be given freely, either plain or carbonized. Seltzer and Vichy are agreeable and useful, and assist in the control of constipation. Bedford and Carlsbad waters are also excellent and more active. Large intestinal irrigations containing some simple antiseptic are useful if the stools are offensive. A two or three grain pill of ox-gall given several times daily will in some degree prevent putrescence of the intestinal contents. Naphthalin is of value for the same purpose, and a useful remedy for the catarrh; it should be given in the same dose. When convenient, I order a warm bath every night, especially during the early period. The water should have a temperature of 100°–105° F., and the bath should last for fifteen or twenty minutes. This affords relief from itching and restlessness, and is also valuable in its influence upon marked catarrhal processes. Under this treatment, associated with well-selected remedies, I observe cases of catarrhal jaundice with elevated temperature and other symptoms of activity recover in much less than the average time.

Medicines are most frequently selected for the combating of the catarrhal process which underlies the jaundice in most cases. There is too much of a tendency to hunt for specific remedies for jaundice, as if it were a disease rather than a simple symptom dependent upon a great variety of conditions.

Those which have given the best results are *chelidonium*, which I

have learned to give in a routine manner when another remedy is not clearly indicated. The second decimal dilution has given good results. Should it fail to relieve *mercurius dulcis* may prove more effective. If the attack occurs in one addicted to dietetic errors or excessive use of alcoholics *nux vomica* should be considered as the initial prescription; and occasionally, if there is much vomiting, epigastric distress, restlessness, and other of the general symptoms of *arsenicum*, this medicine may do good service for the same class.

Cinchona, which is so strongly recommended, has not proven very useful in my experience; nor have I yet observed from *digitalis* and *hydrastis* results which have impressed me that they possess a marked influence over jaundice. The latter should be considered, however, when the breath is foul, the tongue heavily coated, the epigastrium tender and the bowels constipated. Used freely, I have observed relief of these attending symptoms. *Kali bichromicum* is a valuable medicine for catarrhal jaundice if there is much nausea with little vomiting, tongue coated yellowish with red edges, or denuded of epithelium with a dry, red surface.

Chamomilla is in good repute for jaundice caused by nervous conditions, viz., fright or anger, a form but seldom met.

When there are symptoms suggesting diffuse hepatitis *phosphorus* is deserving of first consideration.

My experience with *myrica cerifera*, *podophyllum*, etc., has not yet satisfied me of their special importance.

The pseudo-jaundice, designated hæmatogenous, demands another class of medicines, the most important members of this group being *crotalus* and *lachesis*.

Further assistance in the treatment of jaundice may be gained from the articles upon catarrh of the stomach and bowels, malignant disease of the liver, etc.

CHOLELITHIASIS.

Synonyms.—Gall-stones; biliary lithiasis.

Definition.—The formation of calculi within the gall-bladder and biliary passages.

Etiology.—Cholelithiasis is a disease to which others than the human species are subject, being not uncommon among vertebrate animals. The concretions are developed within the gall-bladder as a rule. They sometimes form in the ducts, though but rarely. They are especially liable to excite symptoms during their passage through the cystic and common ducts. Their origin cannot be said to be thoroughly understood. Their composition varies considerably in different cases. They are, however, composed in large degree of cholesterin, which is separated rom the bile. The importance of this substance as a constituent of biliary calculi calls for a short review of its origin and nature. Choles-

terin is described as a monatomic alcohol, having the formula $C_{26}H_{44}O$. In its pure form it is a white, tasteless, inodorous substance which crystallizes as rhombic plates deficient at one corner. It is soluble in ether, chloroform, boiling alcohol and solutions of the bile acids. It is found in all the tissues of the body in which active changes are going on. It is generally regarded by physiologists as an effete product eliminated by the bile. It is found normally in the bile in solution, in which state it is maintained by the alkaline salts and the compounds resulting from the union of the fatty acids with sodium and potassium. When, however, cholesterin is present in the fluids in excess, relatively or absolutely, or the flow of fluids retarded, it is apt to be precipitated. Precipitation may also result from the presence of calcium salts.

Age and sex are important predisposing factors in the etiology of gall-stones, most cases of the disease being observed in old persons and in women. Whether the bile of old persons contains a relatively large proportion of cholesterin and lime, whether senile weakness of the gall-bladder is present, or imperfectly understood changes in the bile and tubes take place with advancing years, is uncertain. Pregnancy, the sedentary habits of women, the prevailing methods of dress which necessarily impede the discharge of bile, account for the greater frequency of the disease in women. A wandering liver or floating right kidney may possibly become an etiological factor through its compression of the bile-ducts.

Dietetic errors, such as excessive indulgence in animal food, fats, excessive eating with lack of exercise, and all conditions leading to imperfect oxidation, are also important causes. The gouty habit, obesity and chronic endarteritis are also thought to predispose to the formation of gall-stones. Of unquestionable influence are all conditions of the liver and bile-ducts which interfere with the normal rate of discharge of the bile and thus bring about stagnation and separation of the elements normally held in solution by that fluid. Important as is this factor, it does not explain why the constituents of gall-stones differ in so many particulars from the substances normally held in solution by the bile. This statement is illustrated by the fact that the pigment matter of gall-stones is without exception combined with lime. As normal bile contains but a trace of lime, Frerichs has suggested that it is derived from the mucous membrane of the gall-bladder.

The presence of foreign bodies within the biliary ducts, especially certain intestinal parasites or their ova, blood coagula, etc., and a catarrhal condition of the mucous membrane of the ducts, are favorable to the formation of calculi, furnishing, as they do, nuclei to which the cholesterin and other elements entering into the formation of calculi become readily attached.

Morbid Anatomy.—Composition and Structure of Gall-Stones.

Some gall-stones are composed entirely or in a great degree at least of cholesterin. In many, bile pigment is mixed with that substance, while still others are made up very largely of bile pigments associated with lime salts. The bile acids in small quantities, and iron, magnesia and copper, may also be present in small proportions. Calculi consisting of pure cholesterin are pale in color and are crystalline in structure, while others are homogeneous and quite dark in color. Still others are of a greenish or light yellow hue, these tints depending upon the quantity of bile pigment contained in the concretions. Thudicum expresses the opinion that the nuclei of gall-stones consist of moulds of the finer hepatic ducts. Some calculi contain more than one nucleus. When the stones are fresh they are heavy and sink in water, while those that have preserved or have dried out, float. Sections of some of them display a concentric arrangement. Stones of pure cholesterin have but slight consistency, are translucent, and are seldom present in numbers. If containing much lime they are very hard and usually small. Pigmentary concretions, if quite pure, are usually small, presenting a coarse sandy appearance. On the average, calculi are about three-fourths cholesterin.

Location.—While calculi may be found in any portion of the biliary apparatus, they are observed with especial frequency in the gall-bladder. Those found in the larger ducts do not originate *in situ*, but are there *en route* to the intestine, having been arrested in their progress in consequence of their size or by reason of compression of the ducts by growths, etc. Such calculi are generally referred to as "impacted." At the points of lodgment of the concretions, the bile-ducts are dilated. It is not uncommon for them to act mechanically, exciting purulent inflammation and even ulceration, extending into the surrounding hepatic structure. The number of calculi present ranges from a single stone, which may be as large as a hen's egg, to thousands. The size of the stones is nearly always in inverse ratio to their number. When many of them occupy the gall-bladder, they present facets resulting from compression and attrition. Single stones are oval, roundish, polyhedral, or mulberry-like in shape.

Symptomatology.—The presence of gall-stones does not necessarily produce any symptoms, for they may be retained in the gall-bladder for a long period of time without giving rise to any suspicion of their existence; or they may be attended by slight symptoms of an indefinite character referred to the hepatic or epigastric region. In still other cases the first manifestation of ill health appears as an attack of biliary colic, or symptoms arising from inflammatory involvement of the gall-bladder, or persistent obstruction of the gall-ducts associated with inflammatory or destructive changes in the biliary apparatus, any of which may give rise to conditions and groups of symptoms of a most variable character.

The possible presence of calculi without attending symptoms is forcibly demonstrated by the fact that more than one-quarter of all women dying in advanced life have calculi in the gall-bladder. As to the second group of cases, little is to be said except that prior to the passage of gall-stones some persons complain, perhaps for a lengthened period of time, of symptoms of an indefinite character referred to the liver region or to the epigastrium. Biliary calculi have also been found in persons dying suddenly of acute illness, who had previously complained of aching, dragging, and tenderness in the right hypochondrium, also inability to lie comfortably except in certain positions, etc. These symptoms are probably due to attendant conditions and not simply to the presence of calculi. That small and soft calculi may pass the ducts without exciting acute pain or jaundice is undoubted, but in the great majority of cases the presence of gall-stones is first suspected when they begin the passage of the cystic or common duct. The most important symptom is pain, which is usually sudden in onset, but may be preceded by a variety of prodromal annoyances. The pain is exceedingly severe and attains its height quickly. While the pain is continuous there are paroxysmal aggravations, during which the suffering is excruciating. The pain is referred to the right hypochondrium and to the epigastrium, and may radiate to the back and shoulders, often to the right shoulder. Vomiting may attend, and a chill followed by a high temperature is not uncommon. The temperature may reach 103° F., or higher. The prostration attending such attacks is considerable. The pulse is small and feeble and symptoms of collapse may develop. The duration of the pain is most variable, lasting from a few hours to two or three days, or, in rare cases, even several weeks. Most attacks, however, last from six to eight hours; longer ones, twelve to twenty-four hours. The region of the liver is usually tender and the muscles rigid. A most characteristic symptom is the occurrence of jaundice, which usually appears within a few hours of the onset of the pain, if the hepatic or common ducts have been obstructed. It is evident that it cannot occur as a result of obstruction of the cystic duct only. The cessation of pain is usually quite rapid, and takes place when the calculus slips into the intestines, but the relief may be due to a receding of a stone which has ineffectually engaged the duct. Palpation and percussion may reveal a swollen liver, or a distended gall-bladder, or both. The frequency of succession of attacks is most variable. There may be a number of paroxysms at intervals of days or weeks, or months or years may intervene, and it is not rare that the first attack should prove the last.

If the intervening periods are sufficiently long the patient's health may apparently be entirely restored, or various symptoms referable to the affected organ may continue and be due to associated disease. If the violent symptoms abate but do not disappear, and are subject to aggra-

vation at intervals, if jaundice continues in some degree or increases, it is suggestive of impaction of a stone at some point in the common or hepatic ducts. If jaundice has not been present it is indicative of a lodgment in the cystic duct. If this tube is closed the gall-bladder becomes gradually distended with mucus, the contained bile is absorbed, the sac finally containing simple mucus or muco-purulent fluid. Under these circumstances the enlarged gall-bladder may be felt through the abdominal wall. Permanent obstruction leads to inflammatory and destructive changes attended by a variety of general and local symptoms. The first effect is a mechanical one, viz., the development of changes due to pressure, even necrosis of the mucous membrane. About this necrosed tissue inflammation is excited and extends to the hepatic parenchyma with resulting changes of an ulcerative and suppurative character. Jaundice may almost or entirely disappear if the duct is not completely filled by the calculus.

Persistent Obstruction of the Common Duct. The number of stones present varies from one, which usually occupies the pouch-like section just within the papilla, to a number sufficient to fill the tube through its entire length. The result is dilatation of the duct and cholangitis of a catarrhal or suppurative character. The biliary tubes become dilated by the pressure of the contained bile, especially the hepatic group. The calculus may finally escape or be contained in a diverticulum, the passage of bile becoming again possible. The gall-bladder may be dilated, but it is rarely very large. As we have seen, the bile is replaced by a mucous secretion with little color. The liver is little or not at all enlarged. There is some increase of connective tissue, but an absence of the histological characters of cirrhosis. Sharkey antagonizesth e teachings of some authors respecting the occurrence of cirrhosis as a sequence of chronic obstruction. If suppurative cholangitis is set up, the mucous membrane will be found ulcerated and thickened, and the gall-ducts and gall-bladder filled with pus. Foci of suppuration are often established in the liver, this organ being sometimes riddled with abscesses. The gall-bladder may rupture, and abscess is occasionally developed in its neighborhood. Attending these destructive changes there are usually repeated fever paroxysms with pronounced chills, resembling and being often mistaken for malaria. They may continue for months.

The formation of biliary fistulæ is an occasional consequence. A communication with the surface is most common, but fistulæ communicating with the duodenum, colon, ileum, jejunum, stomach, kidney, and urinary bladder, also ulcerated tracts between the gall-bladder and the hepatic duct, and between the common duct and the portal vein, have been observed; in fact there is not a direction in which biliary calculi have not migrated by first exciting ulcerative action.

Obstruction of the Cystic Duct. This is more frequent than

obstruction of the ductus communis. The duct may be obliterated except at the point of lodgment of the calculus. The result of obstruction is distention of the gall-bladder and replacement of its contents with a mucous or purulent secretion. Fluid drawn from the gall-bladder is neutral or alkaline in reaction. The degree of distention may be enormous, in fact the distended gall-bladder has been mistaken for ovarian and other forms of abdominal tumor. It has a peculiar pear-shaped, or gourd-like outline which can be easily discovered by palpation in thin individuals. Jaundice is not present unless some further affection of the bile-ducts or liver exists. The aspirator may assist in the formation of a diagnosis, large quantities of fluid sometimes being withdrawn.

If suppurative inflammation develops (cholecystitis, empyæma of the gall-bladder) the enlargement is often very great, and the contents of the sac are purulent. Perforation in this variety as well as abscess external to the gall-bladder is not uncommon. With progress toward recovery the walls of the gall-bladder may undergo calcification, being converted into a thick bone-like body, or the gall-bladder may atrophy into a small knot of fibrous tissue. The shrunken and thickened bladder may be found closely applied to a large calculus or a number of smaller ones. The gall-bladder has been found with diverticula containing gall-stones.

Diagnosis.—The most satisfactory evidence that an individual is suffering from cholelithiasis is the discovery of gall-stones in the fæcal matter. Persons may, however, pass masses of such consistency as to break up readily in the intestine and not be detected by ordinary methods; and, again, attacks similar to biliary colic may occur even with jaundice, and for a time simulate biliary colic, only the future progress of the case making its nature clear. Any foreign body which may obstruct the common duct, or any morbid growth external to the duct may, according to Sutton, swell at times or change position so as to compress the duct and lead to symptoms simulating biliary colic. The method adopted by the writer for the discovery of gall-stones in the stools is to place the fæces in a large piece of cheese-cloth, which is suspended from the spigot of a hydrant, the cloth being closely tied about the mouth of the pipe to prevent the escape of any of the contents except that portion which is forced through the cloth by the flowing water.

Biliary colic may be mistaken for gastralgia, intestinal colic, neuralgia of the hepatic subdivision of the cœliac plexus, pleurodynia, or pleurisy. Careful attention to the history of the case, to its general features, and to the location of the pain, will generally allow of easy differentiation. As the expulsion of calculi is not invariably painful, the passage or impaction of a calculus, with jaundice, may take place, the true nature of the case not being understood. Under these cir-

cumstances a history of previous attacks of biliary colic is of great assistance.

Prognosis.—Death may occur during a paroxysm, but this is extremely rare. It most frequently occurs as the result of failure of the weakened organs of elderly individuals, especially those with fatty degeneration or serious valvular disease of the heart. It has occurred from collapse excited by rupture of the duct, or from a consequent peritonitis. Inability to discover calculi in the stools after an attack of biliary colic is some evidence that the calculus has been unable to escape and may therefore excite further trouble, but it must be remembered that the calculous mass may disintegrate in the intestine. The shape of the formation should be noted, as the presence of facets indicates the existence of others, some of which may remain. There are reports of the passage of hundreds of calculi within a few weeks. Permanent obstruction must result fatally, but even with full evidence of obstruction considerable hope of relief may be given without the necessity of resort to surgical methods, as many recoveries after three, six or twelve months of obstruction have been observed; recovery even after two and a half and three years has been reported. A case, coming under my own observation, recovered after about one year of impaction. If the duct is not completely obstructed, the damage to the biliary system and the general poisoning with bile and consequent impairment of nutrition are, of course, less. In impaction of calculi it is also interesting to know that the attack of biliary colic may cease and the jaundice disappear without discharge of the concretion, the same body becoming repeatedly engaged, with the result of many attacks of colic before the extrusion of the offending stone.

Treatment.—As the first notice to the patient of the presence of gall-stones is usually the occurrence of an attack of biliary colic, it is appropriate to first consider the treatment of these paroxysms. My own experience agrees with that of most observers, viz., that homœopathic remedies are not adapted to the relief of pain which is purely the result of mechanical violence to a tender part. *Belladonna*, *nux vomica*, *calcarea carbonica*, and other remedies which have been lauded in the treatment of biliary colic have failed in my hands to exert the influence claimed for them, and cannot therefore be recommended. I cannot understand the statement of Hughes that *calcarea carbonica* has never failed him, for this agent quite regularly fails to relieve the pain attendant upon the passage of American gall-stones. Opiates may often be avoided if various of the simpler palliative measures are persisted in, viz., hot fomentations to the liver region, the taking of large draughts of hot water into the stomach, the use of large intestinal injections of hot water, and the hot bath. If these do not afford sufficient relief, chloroform may be inhaled. It usually requires but very little of this agent to keep the

patient comfortable. Hypodermatic injections of morphine in doses of one-eighth to one-third of a grain are more generally employed than chloroform, probably because this method gives relief and greatly lessens the time lost by the attending physician. Care is necessary in the use of morphine, for, under the stimulus of the pain, the system tolerates large doses, such toleration quickly disappearing with the escape of the calculus. There should never be any hesitation as to the use of one of these effective agents for the relief of the suffering, which is of a most intense character.

Prout claimed great relief from large draughts of carbonate of soda in hot water, continuing its use even if the earlier quantities taken were rejected. Olive oil, chloroform, and other substances supposed by some to have this specific influence, are useless. Attempts to dislodge gall-stones by means of manipulation of the region are unwise, even dangerous.

As soon as the paroxysm of pain has subsided a careful investigation into the general health of the patient should be made, avoiding the common error of limiting attention to the liver and digestive apparatus on account of their pre-eminent importance. The necessity for this is illustrated by the cessation of attacks of biliary colic after improvement in chronic obstructive heart or lung disease. The matter of first importance is a regulation of the diet, the simple lessening of the amount of sugar, starch and fat used, being often followed by improvement. In troublesome cases it is best for a time to eliminate as perfectly as possible these articles from the dietary. Malt liquors and, as a rule, all alcoholics should be prohibited. If the patient's condition permits, an open-air life should be followed, with as much exercise as is well endured, a free supply of oxygen being most important. Good results follow a temporary residence at some alkaline mineral spring. In this country Saratoga, Bedford, and White Sulphur Springs are advisable, and abroad, Carlsbad, Vichy, Marienbad, Ems, Vals and Kissingen. Undoubtedly the free use of water, coupled with an out-door life, is more important than any particular spring. I am in the habit of ordering one to three drachms of the Carlsbad Sprudel salt, dissolved in one quart of water, this amount to be taken in each twenty-four hours in addition to other fluids. This treatment probably increases the fluidity of the bile and favors activity of the bowels, thus tending to overcome obstruction. Remedies are of decided value, but it is impossible to enumerate certain ones having a known specific relationship to the formation of gall-stones, but rather to hepatic and digestive disorders underlying biliary lithiasis. Inflammatory change in the bile-ducts has been shown to be an important factor and is also under the control of remedies. Most important is *cinchona*, the clinical value of which was pointed out many years ago by Thayer, of Boston, whose observations have been abundantly corroborated. *Nux*

vomica is also extensively prescribed on its well-known indications. The writer has had better results from *chelidonium* in the lower dilutions. *Calcarea carbonica* has appeared valuable in women tending to obesity, with profuse menstruation and a disposition to local sweats. *Sulphur* and *lycopodium* are prescribed upon the general symptoms of these medicines.

Podophyllum, carduus marianus, chionanthus, colocynth and *laurocerasus* have pathogenetic or clinical evidence suggestive of their value.

If attacks of biliary colic are frequently repeated and attended by serious symptoms, if evidences of obstruction of the common duct or of persistent distention of the gall-bladder are present, attended by pain and fever, the question of surgical interference arises. If distended, the gall-bladder may be aspirated, which proceeding furnishes considerable relief and information. Sims proposed cholecystotomy, an operation which has been very successful, especially in the hands of Mr. Lawson Tait. Cholecystectomy (extirpation of the gall-bladder) has been successfully performed, also exploration of the common duct, with removal of calculi, which is, however, an operation attended by much difficulty.

Accumulation of calculous material may take place in the intestine with resulting obstruction demanding surgical measures.

SUPPURATIVE PYLEPHLEBITIS.

Etiology.—Suppurative inflammation of the portal vein is very rarely a primary affection, but is secondary to some lesion, usually a suppurative one, involving the parts associated with the portal vein. It is therefore a sequence of inflammation and ulceration of the gastro-intestinal tract, especially of appendicitis, dysentery, typhoid fever, ulceration of the stomach, abscess of the spleen or pancreas, inflamed hæmorrhoids, etc. Rare cases have been reported as due to a perforation of the portal vein by foreign bodies which have been swallowed. In the infant it may develop soon after birth from an inflamed umbilicus. A few cases are excited by changes within the liver. Irritation of the gall-ducts by calculi or retained bile, or both, is a common intrahepatic cause. Under these circumstances the intrahepatic branches may be extensively involved. Chronic inflammatory affections, abscess and hydatids, have all been known to excite it.

Anatomical Peculiarities.—The extent of the process may vary from an involvement of a limited portion of one of the larger ducts, or a group of vessels within the liver, to a large portion of the portal system of vessels. The progress may be by continuity, or diseased and normal sections may alternate. The inflammation is excited by infectious particles which become detached and are washed on by the current until arrested, which takes place upon the surface of the larger vessels, or within the minute hepatic branches. The interior may be ulcerated

and the middle and outer coats thickened and infiltrated with pus. The contents are puriform and of a grayish or yellowish-red color. Extension of the inflammation to the parenchyma may eventuate in multiple foci of suppuration. Upon section of the liver multitudes of suppurative points may be visible. The liver is generally enlarged, also the spleen, which sometimes contains an abscess. Should the vena cava become involved or pus enter it, embolism of the lungs or a more general distribution of the emboli may take place.

Symptoms.—In the more acute cases pain is usually present and is referred to the right hypochondrium and to the epigastrium. Extensive suppuration of the portal vein has been observed, however, with little or no pain. Tenderness may be marked. Fever is a prominent feature, and of a remitting or intermitting type and attended by sweats. Chills may be frequently repeated. The fever paroxysms closely resemble those due to malarial infection. Whether the intermittent fever of hepatic disease is due to a special ferment produced in the bile passages or not (Charcot) is uncertain. Jaundice is seldom absent and may be present in a highly developed form. The absence in certain cases of biliary coloring matter in the urine, and a normal amount of bile in the fæces, suggests the hæmatogenous character of the jaundice. The patient loses appetite, and vomiting and diarrhœa are added and accelerate the general failure. Less frequently hæmorrhages into the cutaneous surface and mucous membranes occur, and are indicative of rapid deterioration of the blood or pyæmic conditions referred to the lungs, joints or abdominal cavity.

The duration varies from four or five days to two or three weeks, and in the more protracted form life may be continued from one to two months.

Physical examination reveals an enlarged liver, but not of high degree. The spleen may also be swollen as a result of the general infection or from abscess.

Diagnosis.—The resemblance to pyæmia has been indicated. That to abscess of the liver is stronger, but in abscess of the liver the spleen is not often enlarged, and diarrhœa is absent. In abscess dysentery is the most important cause, while in suppurative pylephlebitis disease of the appendix is more important. Malarial affections may be distinguished by the presence of the hæmatazoon in the blood, and by the influence of quinine.

Prognosis.—There is no hope to offer if the condition is sufficiently pronounced to permit of a diagnosis.

Treatment.—This can only be on symptomatic indications. Reference may be made to the sections upon the treatment of abscess of the liver, pyæmia, etc. If appendical disease is present the necessity for surgical measures must be considered.

CHOLANGITIS AND CHOLECYSTITIS.

Inflammations of the biliary ducts and of the gall-bladder have received considerable attention in the sections devoted to catarrhal jaundice and cholelithiasis, and these should be read in connection with the present article.

Etiology.—Inflammation of the biliary ducts may arise by extension of a catarrhal duodenitis to the mucous membrane of the biliary tubes, or as the result of the irritant influence of biliary caculi or other foreign bodies within the ducts or gall-bladder, or of lesions involving the bile-ducts from without, viz., cancer, hepatitis, and other affections, which, by obstructing the tubes and preventing the normal outflow of bile, lead to its stagnation and decomposition, converting it into an irritating agent. Obstruction may also result from chronic heart or lung diseases, which prevent the outflow of blood from the liver, the distended bloodvessels exerting pressure upon the bile-ducts, and interfering with the outflow of bile. It may arise by extension from the liver. Various of the acute infectious diseases have apparently been the exciting cause in rare instances.

Morbid Anatomy.—The type of inflammation is first catarrhal, becoming suppurative, and rarely pseudo-membranous. Any portion or all of the biliary tract may be involved. The mucous membrane is injected, ecchymotic, and presents the usual appearance of catarrh, or later, may be in a state of ulceration and pigmentation. Perforation may take place, the consequences depending upon whether or not adhesion to neighboring organs has taken place. It is not uncommon for the hepatic parenchyma to share in the inflammatory process with resulting abscess. These purulent foci may be large or small, single or multiple. In the catarrhal and suppurative form the gall-bladder may be involved equally with the ducts, and distended with imprisoned fluid.

Symptoms.—Symptoms may be entirely absent, particularly in cases supervening upon infectious disease, the symptoms of the primary affection obscuring those related to the liver. Observations by Osler upon catarrhal cholangitis associated with gall-stones, indicate that it may continue for several years without suppuration, attended by paroxysms of intermittent fever, jaundice, and gastric irritability increasing after each attack of biliary colic. Between the attacks the temperature was normal and there was no progressive failure in health. In the suppurative variety the liver and gall-bladder may be enlarged, and chills and fever associated with sweats, jaundice, and gastric irritation be present.

The duration is from a few days in the acute form to months or years in the catarrhal. A few cases have recovered.

Prognosis.—This is unfavorable.

CANCER OF THE GALL-DUCTS.

The gall-ducts are sometimes the seat of a primary carcinomatous development. The portion most frequently attacked is the mouth of the common duct. The junction of the common and cystic ducts may also be the point of initial lesion. The walls are thickened by the newly developed tissue with consequent obstruction and jaundice of a persistent and profound type. Suppurative action (cholangitis) may be associated and excite fever and other symptoms (see page 755).

Diagnosis.—Absence of a history of biliary colic and an inability to discover any change in the liver by means of physical examination suggests that a case of rapidly developing and intense and persistent jaundice may be due to cancer of the bile-ducts, but there is always uncertainty as to the diagnosis.

Prognosis.—Death soon occurs from obstruction, often before time has elapsed for the development of a cachectic appearance, or other lesions indicative of the cause.

CANCER OF THE GALL-BLADDER.

Etiology and Morbid Anatomy.—Primary cancer of the gall-bladder is much more frequent than cancer of the gall-ducts, the relative proportion being about one to five or six. Extension from the liver to the gall-bladder is common. Musser's collection indicates that most cases occur in women and in advanced stages of life (fifty to seventy-five years). All varieties of cancer are observed. No form predominates largely. Aside from the presence of gall-stones in association with most cases, no special etiological feature appears to be prominent, unless we consider the dress and other habits of women as accounting, in a measure, for the predominance of this affection among females. Whether gall-stones are the exciting cause of cancer, or the result of retention of altered bile, is uncertain, perhaps both are true. The occurrence of cancer of the gall-bladder so much more frequently in women, who are more subject to gall-stones, is suggestive.

The situation of the lesion is most frequently at the mouth of the gall-bladder, *i. e.*, near to the cystic duct, or involving it. It may begin at the fundus. The entire bladder may be ultimately involved, its walls much thickened, and the interior in a state of inflammation; or, in more advanced stages, ulcerated or lined with excrescences. The density of the bladder-wall will depend upon the form of cancer present, being soft in the encephaloid variety, and firmer and fibrous in scirrhus. The size is usually increased, often enormously so. In rare cases, the gall-bladder is reduced in size. It contains a bile-stained fluid, which is more or less purulent in character, and in many cases gall-stones, less frequently detached portions of the growth. Adhe-

sions may form with adjacent organs. Destructive changes sometimes lead to rupture, which may take place into the peritoneal cavity or adjacent organs, especially the colon, stomach, or duodenum. If the growth is primary, extension to the liver or to neighboring organs takes place. The liver involvement may be much more extensive than that of the gall-bladder. The gall-ducts may be involved and a cholangitis coexist, or the extension may be to the portal lymphatics or to the portal fissure with involvement of the capsule of Glisson, or it may penetrate the portal vein and lead to disseminated growths. The duration is about the same as that of cancer of the liver.

Symptoms.—The most important symptoms are progressive loss of flesh and in many cases the development of a cachexia, the latter being about as often absent as present however; also jaundice, which may develop rapidly if the duct is involved, but which does not appear as a rule until late. Tenderness, pain, and gastro-intestinal symptoms are usually present. The pain may be paroxysmal in character.

A tumor which is smooth or irregular and which may fluctuate or give a sense of resistance, is usually found in the situation of the gall-bladder. Aspiration of this tumor results in the finding of a fluid of the character already described.

Diagnosis.—The location and character of the tumor, its rapid growth, the jaundice, tenderness, pain, and attacks of gall-stone colic, which are often not followed by much relief, advanced age, and the female sex, constitute a combination of symptoms and physical signs which are suggestive of cancer of the gall-bladder.

Prognosis.—Death is inevitable, the disease usually terminating within a few months of its detection.

Treatment.—This is of little avail and only affords relief of symptoms. Surgical measures are more promising, extirpation of the part in the early stage having been recommended, but it is difficult to make a diagnosis sufficiently early to warrant operative interference. Careful treatment of calculous troubles may do much to prevent the development of malignant disease.

ADHESIVE PYLEPHLEBITIS.

Obstruction of the portal vein is due to various causes, most of which eventuate in thrombosis. Probably the most important factors are compression of the vein, which may occur in the course of various disorders of the liver, especially cirrhosis and malignant disease, and inflammatory matter developed during peritonitis. The pressure of abscesses, dilated bile-ducts, swollen glands of the hilus and abdominal tumors have also been observed to cause thrombosis. Retardation of the portal current favors coagulation, particularly if the epithelial cells of the vessel have undergone degeneration. It is probable that changes in the tunica intima are essential to the development of a thrombus.

Morbid Anatomy.—Any portion of the portal tree may be thrombosed. The thrombosis may be complete or partial, if the latter, the lumen of the vessel is narrowed by an annular blood-clot which adheres to the vessel wall, but permits of the passage of blood. The older the clot the lighter in color and the firmer in texture it becomes. Fresh clots are of a reddish or brownish color. The vessel wall undergoes degenerative changes, especially fatty, fibrous and calcareous. If organization occurs, which is occasionally the case, the vessel is transformed into a fibrous cord.

Symptomatology.—The symptoms depend upon the location and extent of the thrombosis. If limited portions of the hepatic vessels are involved there may be no manifest symptoms. If the obstruction is extensive or involves the main trunk, symptoms will appear, the most important of which is ascites. If the obstruction is complete the fluid reaccumulates rapidly after its withdrawal. Gastric symptoms, such as nausea and vomiting, are prominent, and hæmorrhage may occur from any portion of the gastro-intestinal tract in grave cases. The abdominal veins are distended. Jaundice very seldom develops. There is gradual loss of flesh and strength.

Diagnosis.—Obstruction of the portal vein is attended by symptoms which strongly simulate cirrhosis; in truth, the two are sometimes associated. The most important differential points are a history of alcoholism and the presence of a small, perhaps nodular liver, in cirrhosis. The rapid accumulation of the ascitic fluid after paracentesis in portal obstruction has been referred to.

Prognosis.—This is in the highest degree unfavorable.

Treatment.—The general special treatment advised for cirrhosis of the liver is applicable to portal thrombosis. I know of no experiences furnishing reliable indications for remedies to be used in this condition.

AFFECTIONS OF THE PANCREAS.

GENERAL CONSIDERATIONS RELATING TO DISEASES OF THE PANCREAS.

Position and Structure of the Pancreas.—The pancreas is situated in the upper portion of the abdominal cavity in the epigastric and hypochondriac regions, and closely applied to the posterior abdominal wall. It is a large gland, oblong in shape, extremely broad at its right extremity, tapering to its left extremity, and presents a sharp bend towards its large end, the latter being known as the head. The main portion of the gland is called the body. The head is in direct relation with the concavity of the duodenum. *Behind* and *between* these structures (the duodenum and the head of the pancreas) is situated the common bile-duct. The entire gland measures from six to eight inches in length and half an inch to an inch in thickness. Its weight ranges from two to six ounces.

The general structure of the pancreas is that of the salivary glands. It consists of numerous glandular structures, which empty into a main central duct, which traverses the long axis of the organ. This duct has an average diameter of one-eighth of an inch, becoming larger as it emerges and finally opens into the duodenum in company with the ductus communis choledochus. There is also a smaller duct which empties into the duodenum about an inch above the main duct.

Physiology.—While the physiological importance of the pancreas is fully recognized, it cannot be said that the functions of this gland are fully understood. That its secretion plays a very important part in the functions of digestion and nutrition is well known. Notwithstanding this, diseases of the organ are very rare; that is, if we base this statement upon the frequency with which such a condition is diagnosed during life or recognized at autopsies. Possibly this opinion will undergo a great change when the possibility of pancreatic disease is borne in mind in the course of the investigation of obscure abdominal affections. Inasmuch as the discovery of a disease of any part depends upon the recognition of perverted function of that part, the physiology of the pancreas calls for some consideration at this time.

The secretion of the pancreas is called the pancreatic juice. It is a thick, transparent, strongly alkaline fluid, which contains three ferments, the most important of which is pancreatin or trypsin. It has the

property of changing proteids into peptones, it emulsifies fats, and converts starches into sugars. It is interesting to note that pancreatic secretion becomes active immediately after the entrance of food into the stomach. In the course of one or two hours the secretion lessens considerably to become more active again in from five to seven hours after eating, *i. e.*, during the late stages of digestion.

Symptoms Arising from Pancreatic Disease.—The symptoms produced by disease of the pancreas are usually, as already intimated, of an indefinite character. They may be epitomized as consisting of various morbid sensations, evidences of disturbed function and perverted nutrition, the mechanical effects of the pancreatic lesion on contiguous structures, and the physical signs.

(*a*) Morbid Sensations. These include a variety of subjective symptoms which may conveniently be referred to as sensations and pain. Owing, however, to the position of the pancreas and its close relations to other important viscera these can never be characteristic. In many cases they are entirely absent, even in the presence of grave lesions. They are situated in the epigastrium, and give the impression of a deep origin. Whether they are resident in the gland itself or depend upon the effects of disease on neighboring structures is unknown. The morbid sensations consist of a sense of discomfort or oppression, which may be increased to actual pain on the application of deep pressure. Sometimes the effects of the lesion on the peritoneum and overlying structures are plainly evident. Under such circumstances the discomfort and tenderness may be superficial. They vary necessarily with the character of the disease process. Thus, in the case of a large tumor, it is easy to understand the possibility of a sense of dragging or weight.

As to pain, Roberts speaks of one due to implication of the solar plexus as the most important. It may be of a most severe, agonizing character and radiate in every direction. It may be attended with anxiety, restlessness, faintness and even collapse.

(*b*) Disturbed Function. Disturbance of function presupposes disturbance of secretion. The latter may be abnormal as to quality, also in the direction of quantity, which may be increased or decreased. From a clinical standpoint, however, we have not the data by which such abnormal conditions are recognizable. To increased pancreatic secretion have been attributed certain cases of pyrosis and diarrhœa, the stools in the latter case consisting of a slimy or viscid fluid. Such a relation of cause and effect lacks confirmation. Deficient quantity and quality of the pancreatic juice must necessarily result in practically identical symptoms, namely, those of deficient pancreatic digestion. Of these, the one that has attracted the most attention, and also the one to which great importance has been attached, is fatty stools.

The recognition of this symptom is by no means of recent date, it

having been described by Elliotson, as far back as 1833. The fat may appear as solid masses, white or yellow in color. Sometimes it is liquid at the temperature of the body, becoming solid when cooled after ejection. In favor of their diagnostic value may be adduced the fact that they are sometimes present when the pancreas is at fault. On the other hand, they may be present when the pancreas is absolutely normal. Thus they have appeared after the ingestion of an unusual quantity of food rich in fats and in the course of a variety of hepatic disorders. It is not proper, therefore, to regard this symptom as strong presumptive evidence of pancreatic disease until the diet of the patient has been interrogated and found proper, and it has been proven that disease of other organs more accessible to examination can be excluded.

Fatty stools have been particularly well marked in those cases of pancreatic disease in which the liver also was involved, that is, in those cases of the latter in which the entrance of bile into the intestinal tract was interfered with.

The quantity of fat in the stools has sometimes been observed to be far in excess of that taken with the food, a phenomenon which has been explained by the assumption that it has been derived from the absorption of fat in the general system in connection with the emaciation so often attending pancreatic disease.

Walker has called attention to clay-colored stools as significant of pancreatic disorder. In the cases reported by him the stools were very fœtid, and there were no phenomena suggestive of liver trouble. He argued that the coloring matter of the fæces "depends on the mutual reaction of the bile and pancreatic fluid under the influences met with in the intestinal tract." This being the case the presence of the latter is essential to the normal color of the fæces. This observer therefore assumed that clay-colored stools, in the absence of signs and symptoms of liver disease, is a valuable diagnostic symptom of disease of the pancreas.

Attention has been directed to the presence of muscle fibres in the stools after the ingestion of meat in cases of pancreatic disease. Von Mering and Minkowski observed this symptom in a case in which the pancreas had been extirpated. The general impression favors the idea that this symptom is unreliable.

Disturbed nutrition is a characteristic phenomenon of some cases of pancreatic disease. The emaciation which sometimes appears under these circumstances is truly remarkable. It is usually attended by a proportional degree of debility and anæmia. The cause of this condition has not yet been determined. It cannot be due to want of pancreatic juice, for in many of these cases starches, fats and proteids are digested and absorbed through the agency of other organs. Vaughan Harley has attributed it to "non-assimilation consequent upon a form of auto-

intoxication arising from the substances normally secreted by the pancreas being retained in the organism, and there forming leucomaines, whose toxic effects lead to tissue waste and muscular weakness." The disturbed nutrition may, in many cases, be attributed in a measure to the associated disease of other viscera.

Very interesting are urinary changes observed in some cases of pancreatic disease. Glycosuria, though known for nearly a century as an occasional concomitant of disease of the pancreas, has only recently afforded a subject for an interesting discussion. Clinically it has been shown that diabetes may result from disease of this organ, just as the latter may become involved secondarily to the diabetes. Experimentally, removal of the pancreas from dogs has produced glycosuria, polyuria, polydipsia, polyphagia, emaciation, and prostration. It has also been shown that partial removal of the pancreas is not followed by diabetes, even when the portion of the gland remaining is but one-eighth of the normal. Nor does it occur in cases in which the pancreatic duct has been ligated, or until atrophy of the gland has taken place. The relation of the pancreas to glycosuria has been denied by Tilden, who claimed that the above-mentioned results were obtained by the injury of important structures during the operation for extirpation of the gland.

A diminution in the quantity of indican in the urine has some slight diagnostic value. Pisenti explains that the pancreatic juice changes proteids into peptones, and these into leucin and tyrosin, from which indican is derived. If now the pancreatic juice is deficient the quantity of indican in the urine should be below the normal. In quite a variety of intestinal affections it is increased; and this is true of tumors of the stomach and intestines. The indican test may, therefore, be employed in the case of doubtful tumors in the upper abdominal regions.

Nencki has suggested the administration of salol for diagnostic purposes. This substance, when it enters the bowel, is decomposed into salicylic acid and phenol by the action of the pancreatic juice. It is shortly eliminated by the urine, in which it may be detected by the ferric chloride test already given in the section on diseases of the stomach (page 542).

The presence of fat in the urine has been attributed to pancreatic disease. It is, however, a very rare symptom.

(*c*) Mechanical Effects of the Pancreatic Disease on Neighboring Organs and Structures. The short anatomical sketch of the pancreas introducing this article shows that any great enlargement of the head of the organ may obstruct the common bile-duct and so originate jaundice. Its relations to the stomach and duodenum also show that pyloric or duodenal obstruction may also result from pressure of

pancreatic tumors. When the latter break down the product may enter either organ, with resulting hæmatemesis.

Just as the pancreas may obstruct the bile-duct, so may it compress important branches of the portal system of veins, even the vena porta itself. Thus it may cause ascites. From pressure on the vena cava it may cause marked œdema. Pressure on the abdominal aorta has caused aneurism of that vessel in some cases, and a condition simulating aneurism in others.

(*d*) PHYSICAL SIGNS. The physical examination of the pancreas is a very difficult matter. Palpation is the only possible method of investigation. In health the organ is entirely out of reach, and in the majority of cases of disease the changes present do not make physical examinations very valuable. In carrying out the manipulations it is necessary to have the colon and stomach thoroughly emptied in order to secure the best possible results. The abdominal walls must be thoroughly relaxed. The best position is one with the patient on his elbows and knees. Palpation should be performed not only deeply in the episgastric region, but also in both hypochondria.

PANCREATIC HÆMORRHAGE.

Etiology and Pathology.—The causes leading up to pancreatic hæmorrhage are practically unknown. They are at least unrecognizable during life. Friedreich taught that it resulted mostly from passive hyperæmia due to organic disease in the heart, lungs and liver, and was associated with chronic inflammatory changes in the organ. Constitutional agencies are certainly at work in some cases, for there may be hæmorrhagic extravasations discoverable in other organs, *e. g.*, in the lungs. The suggestion that the trouble is due to the action of the pancreatic juice on the tissues does not seem worthy of serious consideration. It is not improbable that some cases are the result of traumatism, although such a history is wanting in those thus far reported. The comparative youth of the patients is worthy of comment. While many of the cases are persons in middle life, a goodly percentage is noted among young adults in their prime.

Pathology and Morbid Anatomy.—In the majority of cases the hæmorrhage is diffuse, the entire pancreas being infiltrated. It presents a dark red or violet color, its meshes of interstitial tissue being filled with fresh or altered blood. In some cases the hæmorrhage extends into the retroperitoneal connective tissue. In others it is continued into the omentum, mesentery, and the kidneys. While the pancreas may be perfectly normal in structure, in the majority of cases microscopic investigation has disclosed a fatty degeneration.

Symptomatology.—The onset of the symptoms of pancreatic hæmorrhage is sudden and characterized by the appearance of agoniz-

ing pain referred to the epigastrium and extending to the lower portion of the chest and over the abdomen. It rapidly increases in severity and is seen associated with nausea and vomiting. The usual manifestations of internal hæmorrhage, viz., restlessness, pallor, coldness of the surface, weak rapid pulse, subnormal temperature and collapse, appear. There is usually more or less tenderness to pressure over the seat of pain. Tympanites is sometimes a prominent symptom.

Diagnosis.—The above description of the clinical phenomena attending pancreatic hæmorrhage.

Prognosis.—This is absolutely unfavorable, death taking place within a very few hours after the accident in nearly all cases. The suddenness of death has been a subject of considerable speculation. It very rarely happens that the quantity of blood lost is sufficient to account for this result. Zenker attributed the collapse to a reflex paralysis of the heart arising from irritation of the solar plexus, in which view he has the support of Osler. In certain mild cases recovery undoubtedly does occur, but under these circumstances the effused blood is liable to set up an inflammatory condition which produces symptoms for a long or short period. Sometimes a circumscribed peritonitis is developed.

Treatment.—No specific treatment can be formulated. Each case must be considered on its merits, and measures for the relief of suffering applied. Recovery being practically out of the question, palliative measures are generally of the most importance.

ACUTE PANCREATITIS.

Like all forms of diseases of the pancreas, inflammation of that organ is a very rare disease; and yet if we are to judge from the experience of Fitz, it occurs with greater frequency than is recognized. That physician has twice diagnosed the disease during life, and confirmed his opinion at the autopsies. He has also observed three other cases, post-mortem. If, then, a physician conversant with and on the alert for cases of pancreatic disease should have this experience, it is not unreasonable to suppose that many examples of pancreatitis are overlooked by those whose studies have not been directed to this subject.

The classification of pancreatitis into varieties as at present adopted in our text-books seems to tend to confusion, inasmuch as it does not follow the system adopted in differentiating inflammations of other viscera. Fitz, to whom most of our recent knowledge respecting the disease is due, recognizes three varieties, which he denominates hæmorrhagic, suppurative, and gangrenous pancreatitis, respectively. Pathological findings seem to indicate, however, that there is one process, namely, inflammation; and this inflammation, like similar processes in other tissues and organs, may proceed to suppuration or even to necrosis.

A more consistent nomenclature, therefore, is one which provides for a simple inflammation, abscess, and gangrene, the actual condition present in each case depending upon the extent to which the pathological process goes.

Parenchymatous and interstitial varieties of pancreatitis have been recognized. The former is characterized by a granular degeneration of the organ, and occurs during the course of infectious diseases, and as the result of the influence of certain mineral poisons. It is the interstitial to which this article refers.

Etiology.—Too few cases of pancreatitis have been studied to enable us to arrive at any definite conclusions respecting the etiology of the affection. It has been observed, however, that a very large majority of the cases occur in men, more particularly those past the age of forty years. Very many of them give a history of previous good health. Many others tell of numerous attacks of indigestion apparently due to gastric or gastro-duodenal disease and characterized by colicky pains, nausea, vomiting, flatulence and diarrhœa. A small proportion of the patients, estimated at about 16 per cent., give a history of addiction to alcohol. Traumatism is known to have produced pancreatitis in a few instances. This cause cannot be an important one, however, for the situation of the pancreas is such as to make it almost inaccessible to mechanical violence without at the same time inflicting severe injury on more superficially placed viscera. It is possible that an inflammation in the duodenum may extend along the pancreatic duct and produce an acute pancreatitis.

Pathology and Morbid Anatomy.—The classification of Fitz affords a convenient basis for studying the pathological changes in pancreatitis. Patients dying during the early stages of the disease display the morbid changes incidental to acute hæmorrhagic pancreatitis. The pancreas is greatly enlarged, its thickness in some cases having been compared to that of a man's arm. This enlargement is especially marked in the head of the organ. As a rule its consistence is increased; occasionally it may be softened. The substance of the organ is the seat of hæmorrhagic extravasations. These are displayed on the surface by mottlings of various shades of red. On section the gland is seen to be bright or dark red, reddish-brown, violet, or even black, which may be diffused or in patches. Sometimes these discolorations are relieved by intermingling of normal fat deposits or foci of fat necrosis. The pancreatic duct contains a bloody ichorous fluid; its branches may be plugged with coagula. The hæmorrhagic extravasations are not limited to the pancreas in all cases. They may extend into the parapancreatic tissue, the mesentery, the meso-colon and the omentum. As a rule the peritoneum is not affected; exceptionally it may take on a mild inflammation.

Microscopically the interlobular tissue is found to be the seat of hæmorrhagic infiltration, cellular and fibrino-cellular exudations. The lobules themselves are likewise affected, though to a much less degree, the ducts of which are filled with indifferent cells. The presence of putrefactive changes at the end of the third day is displayed by the existence of numerous bacteria; but it is not known as yet whether these exist prior to death or not.

Cases which survive the acute stage may go on to suppuration. The post-mortem appearances in these depend in great measure on the duration of the disease prior to the making of the observation. In those in which suppuration has but recently been established, innumerable purulent foci appear. These may rupture into the peritoneum and so produce a fibrino-purulent peritonitis, especially marked in the upper part of the abdomen. As a rule, cases do not die sufficiently early to present these appearances, but go on until the suppurative foci unite and one large abscess is formed. The suppuration may even extend into the surrounding tissues, and burst finally into the stomach or duodenum.

In the gangrenous cases the necrotic changes begin about the fourth day; the tip of the organ becomes shreddy, and the entire pancreas becomes transformed into a dark slate-colored glistening mass. The course of the disease may best be presented in Fitz's own words: "The adjacent parts may be infiltrated with a discolored purulent fluid, or the coils of the intestine near the pancreas may be united by recent adhesions to the under surface of the diaphragm. The latter may show a dirty grayish-white, shreddy appearance, and its thickened substance may contain small collections of dirty gray puriform fluid, the residue itself being quite shreddy.

"On the tenth day the pancreas may be dark brown, dry, firm. It may have a hæmorrhagic coating, or lie in a sponge-like network infiltrated with dirty, green fluid. On section there may be dry, hæmorrhagic masses, with yellow spots of softening, or the lobules may be indistinct with intervening opaque white patches like those to be found in neighboring fat tissue. The hæmorrhagic infiltration may extend beyond the gland. The wall of the duct and the overlying tissue may be necrotic and hæmorrhagic. Tne perinephritic fat and that near the suprarenal capsule may contain extensive hæmorrhages.

"Towards the end of the second week the pancreas may be a soft, black, shreddy, sloughy, gangrenous mass, the central part being capsuled in the peripheral portion. Between the pancreas and the transverse colon may be a large quantity of chocolate-like fluid and large bluish-black clots. Or the tail and a part of the body may be soft, gray, discolored, and infiltrated with a thin ichorous fluid, while the parapancreatic tissue is partly purulent and partly ichorous.

"A few days later the pancreas may be a thin, flabby, friable, grayish

band, lying in a cavity behind the stomach and attached by a few shreds to the omental wall. The cavity may contain ichorous fluid and communicate with the stomach by several openings with frayed edges.

"At the end of three weeks the dark-brown pancreas may lie nearly free in the omental cavity, attached only by a few rotten shreds of fibrous tissue. The cavity may contain abundant ichorous bloody fluid and communicate with the duodenum. During the fourth or fifth week the pancreas may be discharged as a slough from the bowels.

"In the fifth week the pancreas may lie free, as if macerated, in a cavity extending behind the cæcum and descending colon, on both sides of the spine, as far as the pelvis. The contents may be a greasy, grayish-yellow detritus, with fragments of necrotic fat tissue nearly as large as hen's-eggs. The latter are apparently sequestrated from spaces with walls of a dark-brown or iron-rust color.

"At the end of seven weeks the pancreas may be transformed into a cylindrical, shreddy mass of brownish-black friable tissue. This may lie in the omental cavity, which is filled with offensive black fluid, and communicate with the stomach and jejunum.

"Thrombosis of the splenic vein frequently accompanies the pancreatic lesion and is usually parietal. The thrombus in the early stages is soft and dark red, or it may be of a reddish-gray color. It has been found partly puriform and extending to the portal veins, at the end of the second week."

Disseminated fat necrosis, peritonitis, and peritoneal adhesions are frequently associated lesions. Fat necrosis is not often observed in the course of the suppurative disease.

Symptomatology.—Acute pancreatitis generally begins suddenly without premonitory symptoms. Exceptionally, the previous condition of health may be poor. Generally, also, it comes without exciting cause. The first symptoms consist of a severe pain, paroxysmal or continuous, in the upper portion of the abdomen, and sometimes so located as to indicate the pancreas as its origin. In about one-fifth of the cases it becomes general. Nausea soon sets in and is followed by most persistent vomiting. Constipation is nearly always present, and in some cases has been so obstinate that, taken in conjunction with the severe pain, it has given rise to the diagnosis of intestinal obstruction and leads to the performance of laparotomy. Exceptionally the opposite condition, diarrhœa exists. Hiccough and albuminuria are symptoms mentioned as having been present in one case each.

Tympanitic swelling of the upper portion of the abdomen is very common; it sometimes extends and involves the entire abdomen.

The thermometer affords but little diagnostic aid. Fever may be present or absent. When the former, it appears early in the course of the disease and may reach a high point by the second day. Sometimes the reverse condition—subnormal temperature—appears.

Death usually takes place with the patient in collapse, which usually occurs from the third to the sixth day, though sometimes as early as the second.

In the suppurative cases all the phenomena above mentioned are present, with the exception of the collapsic state. At about the third day the temperature becomes elevated and the epigastrium swollen and sensitive. The fever may be associated with chills or a succession of such phenomena. It is irregular in type. While in the majority of instances it is not high, it may reach 105.8°. Slight jaundice is occasionally present. Examination may show both liver and spleen to be enlarged. The patient emaciates and becomes progressively debilitated.

In the course of the third or fourth week diarrhœa becomes a conspicuous symptom, preceded by violent paroxysms of lancinating pain in the epigastrium. The stools are at first thin, yellow and feculent, subsequently becoming profuse and watery. About this time the other symptoms subside., but are prone to recur later.

Some cases of suppurative pancreatitis begin with progressive emaciation, pain being either slight or absent. The phenomena seem to be more suggestive of peritonitis than pancreatitis.

In the final stage of the disease ascites and anasarca set in and the patient dies of exhaustion.

There is a class of cases of pancreatic abscess which are chronic from the outset. There is little or no pain. The patient emaciates gradually. Vomiting is a prominent symptom. Stools are formed, but lack the ordinary fæcal color and are highly offensive. In some of these cases the abscess opens into the duodenum. In some few instances bronzing of the skin and glycosuria have been observed.

Physical examination rarely discloses the presence of a circumscribed tumor in pancreatic abscess. Sometimes deep manipulation discloses a sense of fulness or resistance.

Regarding the causes of pancreatic suppuration it has been suggested that the same occasionally occurs as one of the results of the presence of a pancreatic calculus in the pancreatic duct. In a case reported by Kilgour it originated in a cyst of the organ.

Pancreatitis going on to gangrene of the organ has all the initial manifestations of the acute hæmorrhagic inflammation, up to a certain stage. Chills are, however, occasional phenomena; fever is slight but sometimes may be quite high. The swelling of the upper abdomen may be slight or extreme. Weakness becomes a prominent phenomenon and is associated with vomiting, diarrhœa, evidences of a localized peritonitis and finally collapse.

Diagnosis.—Acute pancreatitis may be mistaken for acute intestinal obstruction, irritant poisoning, intestinal perforation, cholelithiasis, and peritonitis. Obstruction originating in the upper portion of

the intestines is exceedingly rare. Obstruction in the lower portion of the tract is sufficiently distinctive. As affirmative symptoms suggestive of pancreatic inflammation the localized sensitiveness and pain, and the epigastric swelling and tympany may be mentioned.

Irritant poisoning will ordinarily give a history suggesting such a condition, which may be absolutely confirmed or denied by the examination of the vomited matters.

Intestinal or gastric perforation only occurs as the result of previous disease in those organs usually ulcerated. Under such circumstances there will nearly always be preceding symptoms by which such a condition will have been already diagnosed. Thus, pain after eating, hæmatemesis, and anæmia are suggestive of gastric ulcer, but are absent in acute pancreatitis.

Cholelithiasis likewise gives a history sufficiently distinctive. The pain and tenderness are in the region of the gall-bladder; jaundice is often a prominent symptom.

The symptoms on which we must rely for the diagnosis of pancreatitis are violent epigastric pain coming without warning and attended by severe nausea and vomiting, tympanitic swelling of the upper portion of the abdomen, fever, and collapse.

Prognosis.—All the positive knowledge respecting pancreatitis leads us to believe that it is an exceedingly fatal disease. It would almost appear that it is invariably so. Such cannot, however, be the case, because autopsies on cases have shown unquestionably that the patient had suffered from attacks previous to the one which proved fatal. In one of Osler's cases, intestinal obstruction was diagnosed and laparotomy performed. The objective appearances disclosed an acute pancreatitis. The wound was closed and the patient recovered.

Abscess of the pancreas is incurable unless the pus be evacuated. The disease leads to malnutrition and general sepsis. The danger is made especially great because of the proximity of the pancreas to important vessels and organs into which the abscess may rupture. Perforation into the peritoneum is, of course, rapidly fatal; into the stomach is regarded as the least dangerous form of evacuation aside from that with the knife.

Gangrenous pancreatitis has proven invariably fatal with the exception of two cases, in which the organ sloughed and was discharged through the bowel.

In acute hæmorrhagic pancreatitis death takes place in from three to six days. In the case of suppuration, life may be prolonged over many months. Gangrene does not continue over three to eight weeks.

Treatment.—The therapeutics of pancreatic disease is still largely speculative. Undoubtedly much that has been written respecting the value, or want of value, of various remedies is valueless on account of

the doubt surrounding the diagnosis. We may call attention to *mercurius* and *arsenic* as likely to prove of benefit in the acute variety. *Iris versicolor* is also commended by Farrington, Hughes and others. It produced congestion and hæmorrhagic extravasations in the pancreas of a cat. My own most favorable result appeared to follow the use of the *biniodide of mercury*. *Belladonna* also appeared of service in the earliest stage. Behr had favorable experience with *atropia sulph.* in a subacute case. *Iodine* appears to hold the first place for the chronic variety.

Iris versicolor. A distressed, burning sensation deep in the epigastrium; the saliva has a sweetish taste and there is vomiting of a sweetish liquid or of bile. Green, watery stools, increased in the latter portion of the night; stools containing fat, with offensive flatus. Iris is still further indicated if the individual is subject to migraine. *Arsenic* has been prescribed upon its general symptoms, especially the pain, which is intolerable, exciting restlessness and mental distress. The vomiting and diarrhœa are also suggestive of arsenic, the stools being undigested, offensive and containing fat. There may be associated duodenal inflammation or ulceration. *Phosphorus* has been beneficial in acute pancreatitis with frequent vomiting, great thirst and rejection of fluids as soon as warmed by the stomach. There are deep-seated burning distress and pains of acute character, deep in the epigastrium. The stools are watery, offensive, and contain fat. The general character of the phosphorus patient may be of some help in making a selection. *Lycopodium*, according to Dunham, produces a chronic duodenitis, and may, secondarily, involve the pancreas. There are tenderness in the epigastrium and the hypochondria, flatulent dyspepsia, and a uric acid diathesis. I am inclined to think that the cases observed have been affections of the liver, or at least with prominent hepatic complications, indicated especially by jaundice. *Uranium nitrate* has been recommended for the particular reason that it produces ulceration of the duodenum and stomach near to the pylorus. I know of no convincing experience with it. It is indicated by such symptoms as vomiting of light-colored fluid; putrid eructations; pain in the epigastrium, aggravated when the stomach is empty; and a variety of urinary symptoms of which glycosuria is the most important.

If a tumor forms *iodine, conium, biniodide of mercury, kali hydr.*, and *sulphur* should be considered. Buchman recommended the lime preparations, and Farrington *zinc., carbo an.* and *vegetabilis*, and *silicea*, in addition to those already mentioned.

PANCREATIC CALCULI.

Etiology.—Pancreatic calculi are the result of precipitation of the inorganic constituents of the pancreatic juice. Only exceptionally are their nuclei composed of inspissated organic substances. Precipitation

may be brought about by a chronic catarrh of the ducts, obstruction or abnormal composition of the secretion of the pancreas. Calculi are sometimes found in obstructed or dilated ducts, but the association is not necessarily one of cause and effect, as the lithiasis may be either the primary or the secondary condition. Very often the trouble is preceded by sclerosis, tumor, etc.

Pathology and Morbid Anatomy.—Pancreatic calculi may be single or multiple, and range in size from that of a pin-head to that of a walnut or even larger. They are usually white or grayish-white in color. The smaller ones are generally round; the larger are somewhat oval, or they may present a very irregular or roughened surface studded with processes suggesting the comparison to a piece of coral. Chemically, they are composed of carbonate or phosphate of lime, or both salts in combination.

Their presence is not unlikely to produce secondary changes in the pancreas, consisting of dilatation of the ducts, chronic pancreatitis, abscess, and fistulæ opening into the stomach, duodenum or other parts.

The character and extent of dilatation of the ducts varies with the seat and completeness of their obstruction. In the case of involvement of the smaller ducts these parts dilate and appear as small sac-like elevations on the surface of the pancreas. Their contents consist of a greasy substance into the composition of which fat-drops, cholesterin crystals and lime salts enter. There is a marked tendency on the part of the portion of the gland tributary to the obstructed duct to atrophy. This tends to limit the size of the resulting cyst. The fat tissue may be either increased or diminished.

When the calculus is formed in the main duct—the duct of Wirsung, as it is often called—that canal becomes greatly dilated and tortuous, indeed it may be sufficiently large to permit of the introduction of the little finger.

Pancreatic abscess resulting from calculous disease does not present the usual wall of granulation tissue found in abscess cavities. On the other hand, they are found to be composed of dilated ducts in which are found calculi and pus. There is in many instances a marked tendency to destructive changes, evidenced by ulceration and perforation of adjacent tissues, resulting finally, in some instances, in the formation of fistula. Sometimes the calculus escapes into the peritoneum, in which cases a fatal inflammation of that serous membrane is very liable to ensue.

Calculi are sometimes, though but rarely, associated with cancer of the pancreas.

Symptomatology.—In very many instances pancreatic calculi constitute a pathological curiosity, their presence becoming known for the first time at the autopsy. In many such cases they have excited no

symptoms during life. In other instances they have been associated with great suffering, but in many of these it has been impossible to say to what extent the symptoms resulted from the concretion and to such associated lesions as sclerosis, abscess, etc.

The early symptoms consist of disturbed gastric or gastro-duodenal digestion. Sometimes there is severe pain, which may be situated in the region of the pancreas, or which may be paroxysmal in character as in the case of gall-stone colic. The latter phenomenon is especially liable to occur when the stone is situated near the orifice of the main duct. In this locality it is very liable to exert pressure on the ductus communis choledochus, thus causing some degree of jaundice. The differential diagnosis of pancreatic from biliary calculus is thus made a difficult matter. It is sometimes made still more so by the fact that the two conditions may be associated. Some diagnostic aid is obtainable when the symptoms ordinarily held as suggestive of pancreatic disease are present. These include progressive and extreme emaciation, fatty stools, glycosuria, absence of jaundice, and the detection of a tumor in the vicinity of the pancreas. In the glycosuric cases the patient is apt to have an excessive appetite and great thirst.

A positive diagnosis is well nigh impossible. There are no data which enable us to frame a prognosis in individual cases. Special treatment is unsatisfactory for obvious reasons. The recent advances in surgery suggest that with the improvement in diagnostic technique much may be expected from mechanical measures. Symptomatic treatment is always in order and it may be all that is needed in some instances to carry the patient over to a time when the calculus is discharged into the intestines by the operation of natural causes.

FOREIGN BODIES IN THE PANCREATIC DUCT.

Intestinal parasites occasionally make their way into the pancreatic duct. It has been claimed, however, that they only do this after death.

PANCREATIC CYSTS.

Etiology.—Prevalent views concerning the origin of pancreatic cysts attribute their formation to obstruction of the main duct or its branches, which condition may be brought about in various ways. The impaction of calculi has already been referred to incidentally and needs but little elucidation in this place, except to state that cysts arising from this cause rarely, if ever, attain the size of those proceeding from other causes. Obstruction may likewise arise from cicatricial contraction of the pancreas. Such a condition presupposes an antecedent inflammation of the organ. The cicatrix may be found in the peri-pancreatic tissue or within the glandular structure itself. Inflammation starting in the

duodenum and extending into the duct of Wirsung may produce obstruction of that canal, and thus induce cystic formation. How far traumatism may become an etiological factor is at present unknown. It is generally believed, however, that it plays a minor part in pancreatic pathology. When pancreatic cysts do arise from traumatism they are believed to consist of circumscribed accumulations of fluid in the region of the pancreas rather than in the substance of the gland itself and to depend upon an encysted peritonitis. Senn argues that the influence of traumatism is greatly underestimated, for the pancreas is a friable organ of loose texture. He believes that when the stomach is empty and the abdominal walls relaxed, a blow may lacerate the glandular tissue without inflicting injury or causing rupture of its envelope. Then again traumatism may cause laceration by traction on the gland during the production of a displacement. In still other cases the injury is sufficient to set up an inflammation from which obstruction of the main duct or one of its branches results. Displacement of the pancreas arising in other ways may also produce obstruction. Extreme relaxation of the connective tissue attachments of the gland permitting it to descend by its own weight, and pressure upon the gland by adjacent tumors, are causes readily conceived of and which must be occasionally operative, rare though they may be.

Pancreatic cysts occur with about equal frequency in men and women, and are observed but rarely except in adults. Congenital cases have been reported.

Pathology and Morbid Anatomy.—Cysts of the pancreas may consist of one or more cavities, in other words they may be monocystic or polycystic, and originate in any portion of the structure of the gland. They practically always result from retention of fluid in an obstructed duct or in lacerated pancreatic tissue. In the majority of cases their walls are thin, which is especially true of tumors of rapid formation. In chronic cases attended by considerable production of connective tissue in the surrounding structures, they may be quite thick and hard, the firmness of the tissue at times suggesting cartilage or bone. The inner surface of the cyst walls may be smooth or trabeculated, interspersed at times with circumscribed thickened patches. Sometimes papillary excrescences project from the walls. Numerous secondary cysts may communicate with the main tumor.

The contents of pancreatic cysts may at times reach an enormous quantity, examples in which as much as fourteen quarts were found having been reported. Ordinarily, the contained fluid is more or less viscid, highly alkaline in reaction, and of a specific gravity ranging from 1010 to 1024. In recent cases it presents many of the properties of the pancreatic juice, especially so in the case of small and recent growths. Its ability to digest albumin or fibrin is often lacking. In

old cysts albuminoid degeneration or hæmorrhage into the sac is very liable to take place. This hæmorrhagic tendency has been held to be strongly significant of pancreatic cysts; especially so in cases of traumatic origin, in which fresh blood, blood pigment and even coagula may be found, but cases not infrequently occur in which not the slightest indication of the presence of blood is obtainable. Some cases appear to originate in or be dependent upon malignant disease of the pancreas.

Pancreatic cysts are very uncertain in the rapidity of their enlargement. Cases exhibiting remarkable chronicity have been reported. In Martin's case the tumor was of sixteen years' duration. On the other hand, they may form very rapidly, *i. e.*, they may attain a large size within two or three months. Sometimes after remaining stationary for a number of years they enlarge very suddenly. Cases of the latter character suggest an intercurrent hæmorrhage.

Progressive enlargement of the cyst results in atrophy of the surrounding glandular tissue. The stomach is pushed forward and the tumor occupies the lesser omental cavity. Sometimes it projects above the stomach, the latter organ being displaced downward. Sometimes it forms adhesions with the posterior wall of the stomach. Rupture may take place, usually into the peritoneal cavity or the stomach.

Symptomatology.—As a rule, cysts of the pancreas produce no symptoms until they have attained sufficient size to make their presence known objectively. In such cases the tumor is discovered accidentally. Pain is often an important symptom. It is situated in the epigastric region or in the upper portion of the abdomen, extending in various directions. Sometimes it shoots into the left shoulder. It is often quite severe and attended by collapsic phenomena. Not infrequently it is associated with prominent gastro-enteric symptoms, such as nausea, vomiting, flatulence and diarrhœa. There may be local tenderness. The appetite is fickle, and may be almost destroyed or voracious. The general condition of the patient varies with the case. In some it is most excellent, while in others the profound prostration and emaciation common to pancreatic disease is present. When the tumor is a large one the latter condition is very apt to prevail. Glycosuria and fatty stools are only exceptionally present.

The situation of the tumor depends upon the portion of the pancreas in which the cyst has formed. When the tail is involved the tumor is especially prominent to the left of the median line; when the head, it may be found to the right and suggests the possibility of a distended gall-bladder. In the majority of cases it appears first in the left hypochondrium between the costal cartilage and the median line. To palpation it is globular and resistant. Pulsations may be detected owing to the contact of the growth with the abdominal aorta.

Diagnosis.—Pancreatic cysts may be mistaken for malignant disease of the pancreas, aneurism of the abdominal aorta, echinococcus cysts, affections of the retro-peritoneal glands, hydro- or pyo-nephrosis, cystic disease of the suprarenal capsules, circumscribed peritonitis with exudation, ascites and ovarian cysts. The general characteristics of pancreatic cysts which favor the diagnosis of that condition are the presence of a smooth globular tumor situated in the epigastrium or left hypochondrium, separated from the liver and spleen by a zone of percussion resonance. The tumor is movable especially in a vertical direction. It lies behind the stomach as evidenced by the information obtained by inflation of that organ. The characteristics of the fluid obtained by aspiration also afford diagnostic aid. It is alkaline in reaction, often contains blood elements, emulsifies fat, saccharifies starch, and may peptonize albumin.

Malignant disease of the pancreas is characterized by the well-known clinical features of tumors of that class. Constitutional symptoms appear early, and are well marked. The patient develops early emaciation, and soon becomes cachectic. There may be a previous history of malignant growths. The tumor is solid, as shown by aspiration, and palpation reveals it to be hard and presenting an irregular surface. Sometimes cysts of the pancreas undergo malignant degeneration. Such cysts are multilocular, while ordinary pancreatic cystoma is unilocular.

The liability of mistaking pancreatic cysts for aneurism of the aorta arises from the fact that the latter tumor lies immediately in front of and in contact with that great vessel. The pulsation, however, is a transmitted one, and consequently is not expansile. In aneurism the pulsation is in all directions. In the case of pancreatic cyst it disappears when the patient is placed in the genu-pectoral position, gravity causing the growth to recede from contact with the vessel.

Echinococcus cysts exhibit a peculiar fremitus and are multilocular. The characteristic hooklets are often found in the aspirated fluid.

Disease of the retroperitoneal glands, when sufficiently advanced to produce a tumor simulating one of the pancreas, will be associated with evidences of lesions of adjacent structures and marked constitutional phenomena.

Hydro- or pyonephrosis can be recognized by the history of the case and the examination of the urine. It is especially when this condition involves the left kidney that errors may arise. The tumor is, however, lower placed than in the case of pancreatic cyst, and is located more laterally.

A differentiation of cysts of the suprarenal capsule and the pancreas seems impossible. The bronzing of the skin generally regarded as characteristic of disease of the former bodies may occur also in affections of the latter.

Circumscribed peritonitis with effusion gives a history of antecedent pain, fever and tenderness.

The composition of the fluid removed by tapping is of great diagnostic value.

Ascites can only be simulated by a pancreatic cyst when the latter is of unusual size and fills the entire abdomen. The physical signs of ascites are so unmistakable that an error seems very unlikely, especially in view of the probability of strong evidence of the causes which lead up to ascites being present.

It seems improbable that tumors arising from such far removed organs as the pancreas and ovaries could be mistaken for each other; yet such has occurred to men of unquestioned ability. When the cysts are large and fill the entire abdominal cavity, a differentiation based on the present status of the case may prove impossible. The history should here prove an invaluable help. In pancreatic cyst the enlargement is first noticed in the epigastrium or the left hypochondrium. The associated symptoms are referred to the gastro-enteric system. Ovarian cysts begin in the lower abdomen, and are attended by uterine and ovarian symptoms.

Prognosis.—The prognosis of pancreatic cysts is unfavorable so far as recovery is concerned. Patients suffering from the disorder may live on for years in comparative comfort. Some cases pursue a very rapid course. The danger lies in the possibility of rupture into important cavities and viscera. This may give rise to serious or fatal hæmorrhage at once, or it may produce suppurative inflammation. Another danger is found in the mechanical pressure of the tumor on adjacent organs interfering with their functions. It is not unusual for the stomach to be so compressed as to interfere with its peristalsis and excite obstinate vomiting. Very large cysts may interfere considerably with the action of the circulatory and respiratory organs.

Treatment.—The treatment of pancreatic cysts is strictly surgical, consisting in either extirpation or obliteration of the cyst.

TUMORS OF THE PANCREAS.

These include sarcomata, carcinomata, lymphomata and tuberculomata. Of these carcinomata are the most common.

CANCER OF THE PANCREAS.

Etiology.—Cancer of the pancreas may exist either as a primary or as a secondary affection. As the former, it seems to be exceedingly rare. It seems to be a very difficult matter to estimate its frequency because of the failure of reporters to distinguish sufficiently between primary and secondary growths. Willig found but 29 cases in 467 autopsies on can-

cerous patients. Foerster saw only 6 cases of cancer of the pancreas, and all were secondary growths, in 639 autopsies on all kinds of cases of disease. It is observed more frequently among men than among women, DaCosta and Segre each finding the relative frequency in the two sexes to be two to one. It attacks by preference subjects past forty years of age. Cases have, however, been observed in childhood, and it is said that the disease may be congenital.

Pathology and Morbid Anatomy.—The varieties of cancer which may affect the pancreas are scirrhous, encephaloid, gelatinous, and cylindrical-celled. Any portion of the organ may be involved. Usually, however, it first invades the head of the pancreas, and may there produce a tumor as large, in extreme instances, as the size of a child's head. Under such circumstances it may exert sufficient pressure upon the duodenum to cause intestinal obstruction. The duodenum may become involved by extension of the growth.

Some pancreatic cancers are exceedingly vascular. Hæmorrhages into the substance of the gland not infrequently occur and may cause death. Whether the growth starts in the head or the tail of the organ it soon spreads and may involve the entire gland. The unaffected portions of the pancreas may present a perfectly normal structure. The pathological process may extend to neighboring organs, involvement of the duodenum having already been mentioned. The stomach, especially its pyloric extremity, may be invaded, and secondary nodules have been found in the liver, spleen, gall-bladder, colon and small intestines. The cancerous tumor is usually so situated as to press upon the duct of Wirsung and the common bile-duct.

Symptomatology.—The early stages of cancer of the pancreas are not so apt to be symptomless as are other diseases of this organ; notwithstanding this, cases have been reported in which cancer was found post-mortem, without its existence having even been suspected during life. The first symptoms complained of are those of gastro-duodenal indigestion, to which reference has already been made. They consist of loss of appetite, aversion to meat, sense of distention in the epigastrium, and flatulence. Vomiting is often present and may be severe. In the latter case it is believed to be the result of duodenal or pyloric obstruction from compression. In the latter stages the vomited matters contain blood owing to ulceration of the growth which may have involved the stomach. Pain is an early and important symptom. It was present in thirty-two out of Da Costa's thirty-seven cases. It is exceedingly severe and almost constant. Its course is usually characterized by paroxysms of exacerbation and periods of amelioration. It is believed to depend upon implication of the cœliac plexus or on chronic inflammation or cancerous infiltration of the peritoneum. There may also be local pain and tenderness on pressure deep in the epigastrium or in the hypochondria. According to Friedreich,

position has a decided modifying influence on the pain, being much worse when the patient is upright, and better when he maintains a flexed position forward.

The next symptom and the one on which the most reliance is to be placed is the presence of a tumor. This is not, however, always detectable. Da Costa reports that it could be found in only thirteen out of his thirty-seven cases, and from the statistics given by other observers it does not seem possible to discover it in much more than half the cases. It is situated in the epigastrium behind the stomach, and appears a hard, immovable or slightly movable tumor. It sometimes transmits the pulsations of the abdominal aorta, and consequently may be mistaken for aneurism of that vessel. The points for differential diagnosis are the same as those already given for pancreatic cysts.

Jaundice is a very common symptom; but is present only in cases in which the head of the pancreas is the seat of the disease. It is exceedingly uncommon in cancer of the body or tail of the organ. The appearance of the jaundice is usually preceded by chills, and it persists until death. While usually due to pressure upon the common bile-duct, it may result from extension to the gall-bladder. Ascites is one of the later symptoms and depends upon obstruction of the portal vein by the tumor.

The bowels may be either loose or constipated. Fatty stools are by no means uncommon. Very strongly suggestive of the deficient pancreatic secretion is the presence of undigested muscle fibres in the stools. Albumin or sugar may be detected in the urine. The absence of indican from the urine is an important symptom, as is the salol test for the presence of pancreatic secretion in the duodenum.

Diagnosis.—The diagnostic data given under pancreatic cysts apply in the recognition of cancer. There is, in addition, the absence or diminution of indican in the urine, and the information afforded by the salol test. Cancer of the pylorus may be mistaken for that of the pancreas, but it is more freely movable, is attended by the signs of dilated stomach, and examination of the gastric contents shows the absence of hydrochloric acid. Cancer of the duodenum cannot be differentiated from that of the pancreas. Cancer of the colon will be attended by an excessive quantity of indican in the urine.

Prognosis.—The prognosis of cancer of the pancreas is absolutely unfavorable. Death usually takes place in the course of three or four months after the discovery of the tumor. While emaciation is a feature of malignant disease in any situation, it is particularly so in the form under consideration. When jaundice and ascites appear, the case is hardly likely to survive more than a few weeks.

Treatment.—Therapeutic measures are only effectual in relieving symptoms, and are based purely on indications.

SARCOMA OF THE PANCREAS.

Sarcoma of the pancreas is exceedingly rare, Friedreich claiming that there is but one reliable case reported of this form of tumor occurring primarily in the pancreas. Mayo reported a case involving the entire organ, and Lepine and Cornil one in which the head was involved. Sarcoma presents no clinical features to distinguish it from carcinoma of the pancreas.

AMYLOID DEGENERATION OF THE PANCREAS.

Amyloid degeneration of the pancreas occurs only in association with extensive processes of a like nature in other viscera. The morbid changes extend along the bloodvessels of the gland, particularly the small arteries and capillaries. It cannot be recognized during life.

FAT NECROSIS.

Disseminated fat necrosis is a condition in which numerous necrotic foci are found in fat tissue. Being a condition not discoverable during life, its entire interest in the present connection is that of a phenomenon relating to pancreatic pathology. Among the lower animals, necrotic foci are not very uncommon. In man they are found in connection with certain wasting and other chronic diseases, and especially in association with certain diseases of the pancreas.

The literature bearing on the subject is as yet small, and the observations recorded are not sufficient to permit the formation of any definite conclusions. When the lesions are numerous, pancreatic disease has always been found. It seems to be especially liable to attack adipose persons, although thin subjects are by no means exempt. In some instances it is the cause of death by reason of the quantity of fat destroyed or by the production of hæmorrhage. It is especially apt to occur in association with hæmorrhagic and gangrenous pancreatitis, rarely with the suppurative variety. In the beginning the lesions are observed more particularly in the fat tissue in or near the pancreas.

The lesions are shown macroscopically by opacity of the affected fat tissue, due to the presence of fat crystals or of fatty acids combined with lime. It has been suggested that the changes are due to the action of the pancreatic fluid. Ernst and Welch have discovered the presence of bacteria in the necrotic foci. Salzer believes the disease to be of mycotic origin. He found it in Hungarian and Algerian swine, but not in German swine except such as had been fed on maize. Salzer discovered a fungus resembling that of actinomycosis in the fat necrosis of swine.

The necrotic foci of this disease have been found in the fat within

and about the pancreas, in the subperitoneal fat tissue of the abdominal walls, mesentery, omentum and diaphragm. They vary greatly in number in different cases; and in size may range from that of a pin's head to that of a hen's egg. Some are surrounded by a slight vascularity, and others are of a yellowish-brown zone, the remains of an old hæmorrhage. The lesions seem to indicate a primary crystallization of the fat, followed by an inflammatory line of demarcation and hæmorrhage. The lesions may thus become sequestrated, and if they occur about the pancreas and in sufficient numbers, this organ may finally be discharged through the intestine.

CHRONIC PANCREATITIS.

Etiology.—The data at present at our disposal indicate that chronic pancreatitis is usually the result of some antecedent inflammatory affection of one of the organs adjacent to the pancreas. Sometimes it represents the termination of a suppurative process in the latter organ. Alcohol is believed to be productive of the disease in some instances, not because of the discovery of any definite relationship existing between the use of this substance and pancreatic inflammation, but rather because that poison is known to produce pathological changes of similar kind in the liver. Some cases undoubtedly originate in a chronic gastro-duodenal catarrh, the inflammation reaching the pancreas by extension along the pancreatic duct. Confirmation of this cause is found in those cases disclosing a chronic pancreatitis post-mortem, with a history of a long-continued digestive disturbance. Syphilis has been assigned as a cause, but clinical observations based on the study of the acquired disease indicate that it rarely involves the pancreas. In ninety-seven cases of acquired syphilis the pancreas was not affected once. It is different, however, with congenital syphilis. Birch-Hirschfeld found the pancreas diseased in thirteen out of twenty-three cases of that affection. Obstruction of the pancreatic duct by a calculus is held to be the most frequent cause of cases originating within the organ. It is believed that chronic circulatory diseases, as those of the heart and lungs, may cause fibrous change in the pancreas just as they do in the liver.

Pathology and Morbid Anatomy.—The essential lesion of chronic pancreatitis is an overproduction of connective tissue, thus leading to the designation chronic interstitial pancreatitis or sclerosis of the pancreas. This change may be diffused throughout the entire gland, or it may be limited to a part of it, especially to the head. When the former, the gland is generally uniformally enlarged, perhaps to as much as one-third greater than its normal size. Its vascularity is increased, also its consistency, the latter to such an extent as, at times, to resemble that of cartilage. The abnormal interstitial tissue is sometimes distributed irregularly through the organ, and is visible as bands or distinct tracts. The

surface of the organ may be smooth or granular. The color of the pancreas does not depart from the normal, or it may be yellow or white. On section the tissue presents a homogeneous or granular appearance. In the latter case the granules vary considerably in size. The ducts may be normal or they are dilated, tortuous, or in other ways distorted.

With long continuance of the disease the connective tissue overgrowth leads to atrophy of the glandular structure, and the pancreas diminishes greatly in size.

In the case of circumscribed sclerosis, *i. e.*, examples of pancreatitis in which the fibrosis is limited to the head of the organ, the localized enlargement may give rise to the suspicion that the trouble is really a neoplasm. Indeed, it has been suggested that some of the cases of so-called scirrhus of the pancreas were in reality examples of chronic interstitial pancreatitis.

Symptomatology.—Chronic pancreatitis presents no clinical features to make its discovery during life at any time an easy matter. Its symptoms may in a general way be summarized as those of digestive disturbance. The patient complains of loss of appetite, nausea, flatulence, waterbrash, epigastric fulness, etc. When they have continued for a long time, they may be supplemented by emaciation and debility. The bowels may be either loose or constipated. If the former, which is more frequently the case, the stools are often colorless or fatty. If pain is present, it is situated in the epigastrium and is usually of a dull boring character. Still it may be paroxysmal, and exceptionally, sufficiently severe to produce anxiety, restlessness and even fainting. Glycosuria has been discovered in a number of cases, but it is not of sufficient frequency to make it an important symptom, at least for diagnostic purposes.

Prognosis.—Inasmuch as our positive knowledge of the existence of sclerosis of the pancreas is only obtainable post-mortem, the possibility of curing the disease is highly problematical. Cases in which all the phenomena of this disorder were present have recovered.

As to the likelihood of an early fatal issue, the indications favor the view that chronic pancreatitis is a disease of exceedingly long duration, sometimes running a course of many years. Experimental investigations also favor this idea, for it has been shown that patients and animals may be deprived of quite a large portion of the pancreas and still continue to live with a fair degree of comfort.

AFFECTIONS OF THE BLOOD.

GENERAL CONSIDERATIONS RELATING TO DISEASES OF THE BLOOD.

Color of the Blood.—The blood varies in color according as it is derived from the arteries or the veins, the arterial blood being of a much brighter hue than the venous. In health these differences depend upon alterations in the quantity of hæmoglobin and varying degrees of oxygenation of the blood. Alterations are observed in pathological states also, as has been stated elsewhere in referring to special diseases.

The Reaction of the Blood.—The reaction of the normal blood is alkaline when freshly drawn from the bloodvessels; but after it undergoes coagulation it becomes acid, the acidity increasing with the duration of exposure. The reaction of the blood may be tested after the method proposed by Zuntz. He uses glazed litmus paper soaked in a solution of common salt nor sulphate of soda, which he dips into the blood to be tested. He then washes it again in the salt or sulphate of soda solution.

The tests for determining accurately the degree of alkalinity of a given specimen of blood are too intricate for clinical use.

Specific Gravity of the Blood.—The normal specific gravity of the blood is stated as ranging from 1045 to 1055. It is most conveniently determined by Landois's modification of Roy's method. A series of test-tubes containing solutions of sulphate of soda of different specific gravities ranging from 1035 to 1075 is required. Into each one of these a drop of blood from a pipette is dropped, until one is found in which the blood neither sinks nor rises. The specific gravity of that solution represents the specific gravity of the blood under examination.

The Corpuscular Elements of the Blood.—The corpuscular elements of the blood consist of the red and white blood-cells, and the blood-tablets or blood-plates. The first two named have long been recognized, and are readily discernible under the microscope without much trouble in preparation.

The red blood-cells consist of small bi-concave disks, having a diameter of $\frac{1}{3000}$ of an inch; and a thickness of $\frac{1}{12000}$ of an inch. In all blood specimens there are corpuscles of this variety much smaller than the standard size; although in healthy blood they are very few. In certain disease processes they are far more numerous, and the actual shape of

the cells themselves is greatly altered. In normal blood the number of red blood-corpuscles ranges from five to five and a half millions to the cubic millimetre in the male, and from four to four and a half millions to the cubic millimetre in the female.

In a fresh specimen of blood the red blood-corpuscles soon arrange themselves in rolls, which have not inaptly been compared to rolls of coins. When diluted with solutions of salt, sulphate of soda, etc., they sometimes lose their circular outline and become crenated. The normal blood-corpuscle does not possess a nucleus.

The white blood-cells are much less numerous than are the red. They range in diameter from $\frac{1}{2000}$ to $\frac{1}{2500}$ of an inch. More will be said of their physical characteristics in speaking of their importance in the clinical investigation of disease.

The diagnostic significance and functions of the blood-plates are unknown. These bodies are about half the size of red blood-corpuscles. They are observed under the microscope singly or in groups. They are only discernible when the blood has been fixed by the addition of some preserving solution, Hayem's solution being preferred by most hæmatologists for this purpose. This solution consists of 1 gramme of chloride of sodium, 5 grammes sodic sulphate, 0.5 gramme of mercuric chloride, and 200 grammes of distilled water.

The pathological changes in the corpuscular elements of the blood are both quantitative and qualitative. Each of the elements mentioned may be increased or decreased in numbers, absolutely or relatively.



FIG. 54.—MIXING TUBE.

Determination of the Number of Blood-Corpuscles.—A variety of apparatus for the estimation of the number of red and white blood-corpuscles has been devised, but of these only a few are practical for clinical purposes. The most popular of these is the Thoma-Zeiss hæmatocytometer. This instrument consists of two parts, a mixing tube and counting chamber. The former consists of a tube 10 centimetres in length. At the junction of its middle and upper third it expands into a bulb, which contains a small glass ball, free to move about the chamber thus made. The main portion of the instrument is of capillary size. The stem below the bulb is divided into ten spaces, designated 0.1. Above the bulb is noted the marking 101. This figure having been obtained by reason of the fact that the capacity of the bulb is just one hundred times that of the capillary tube to the mark "1." To the upper end of the mixing tube is attached a piece of soft rubber tubing.

The counting chamber consists of a glass receptacle, exactly 0.1 mm. in depth, cemented on a glass slide. The floor of this cell is accurately divided into squares so that the space overlying each division has a capacity of $\frac{1}{4000}$ cubic millimetre. For convenience in counting the squares are divided into groups of sixteen by additional lines bisecting each fifth space.

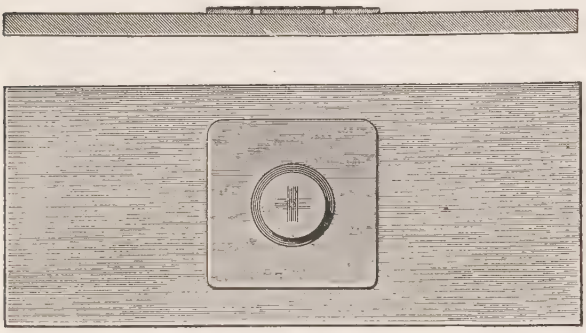


FIG. 55.—MICROSCOPE SLIDE WITH COUNTING CHAMBER.

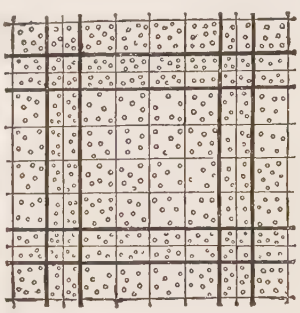


FIG. 56.—MICROSCOPE FIELD SHOWING RED CORPUSCLES IN SQUARES.

To use this apparatus, the finger or lobe of the ear is punctured in order to get a drop of blood. The latter locality has the advantage of being less sensitive than the former. A needle or any clean pointed instrument may be used for the purpose, but a specially devised lancet which is sold with the apparatus is the best. The point of the mixer is then placed in the summit of the exuding drop of blood, which is sucked into the tube until it reaches the mark 0.5 or 1.0. Next the point of the tube is carefully wiped, and a 3 per cent. salt solution is drawn into the tube until it reaches the mark "101." We now have in the bulb a mixture of blood and salt solution. To insure homogeneity, this is shaken for a few seconds, the agitation of the ball securing perfect mixture.

The next step in the process is the placing of the blood mixture in the blood chamber. The portion of the fluid in the capillary stem of the mixer consists of salt solution only; hence it must be blown out before the blood mixture can be placed in the cell. In filling the latter with the mixture of salt solution and blood, care must be taken that no bubbles of air are admitted. The cover glass must be accurately adjusted so that Newton's color rings may be seen at the margin of the drop. In order to secure an even dissemination of the corpuscles throughout the fluid, the preparation is permitted to stand for several minutes, and is then placed under the microscope. We next proceed to count the number of red blood-cells in a certain number of squares—say sixteen. For accuracy's sake in counting, all cells which

are in contact with the upper and left-hand margins of the squares should be included in the enumeration, while those in contact with the lower and right-hand margins should be ignored. Having counted the number of corpuscles in the sixteen squares we proceed with their estimation in a cubic millimetre of blood. According as the quantity of blood taken into the mixer reach the mark 0.5 or 1, the number of corpuscles in sixteen squares is multiplied by 200 or 100 respectively. This result is next multiplied by 4,000, because the cubic contents overlying each square is $\frac{1}{4000}$ of a millimetre. We now have next to divide the result by 16, the number of squares over which the corpuscles were counted, which gives the number of red blood-cells to the cubic millimetre of blood.

Example: In sixteen squares we count 138 red blood-cells. Our watery mixture of blood is 1:100; multiply 138 by 100, which gives 13,800; multiply this again by 4,000 and obtain 55,200,000; this result is divided by 16, and gives 3,450,000, which is the number of red blood-cells in a cubic millimetre of the blood under examination.

To estimate the number of white blood-corpuscles, other preparations are necessary. "Thoma dilutes the blood with water containing one-third per cent. glacial acetic acid in the proportion of 1:10. In this way the red corpuscles are destroyed, and the white alone remain in the field of vision."

Still more convenient for clinical purposes is the employment of the solution employed by Toison instead of the 3 per cent. salt solution for diluting the specimen, and the formula of which is as follows:

Distilled water, ...	160 cc.
Glycerin, ...	30 cc.
Sulphate of soda, ...	8 grms.
Chloride of sodium, ...	1 grm.
Methyl-violet, ...	0.025 grm.

This solution stains the white blood-cells, leaving the red unaltered. It becomes, therefore, a very easy task to distinguish between the two. The number of white corpuscles being so much less than the red, it is necessary for the sake of accuracy to base the count on a much greater number of squares than that recommended in estimating the red. The number of white corpuscles to the cubic millimetre under normal circumstances ranges from 5,000 to 7,000 per cubic millimetre of blood.

Estimation of Hæmoglobin.—For the estimation of the amount of hæmoglobin for clinical purposes the hæmometer devised by von Fleischl is the most convenient. This instrument consists of a stand (see Fig. 5) on which is made to move a frame holding a wedge of glass stained with cassian purple. Surmounting the stand is a small double

reservoir, in one compartment of which is placed plain water, and in the other a definite mixture of blood and water. The quantity of hæmoglobin is determined by moving the wedge along until the shade presented corresponds with that of the blood mixture. The reading then gives the percentage of hæmoglobin as compared with the normal standard.

To prepare the blood mixture, the finger or lobe of the ear having been properly cleaned, is punctured with a suitable instrument, and the drop of blood taken up by one of the small pipettes accompanying the

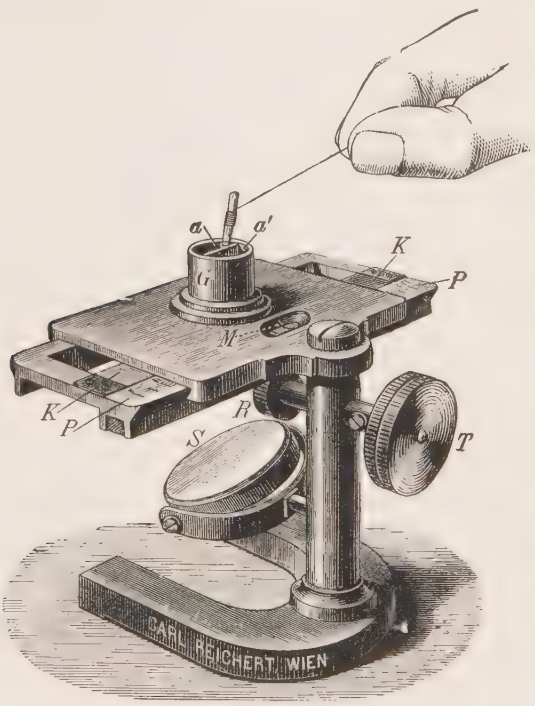


FIG. 57.—VON FLEISCHL'S HÆMOMETER.

a, compartment for blood mixture; *a'*, compartment for plain water; *K*, prism of glass stained with cassian purple; *P*, frame for carrying same; *M*, index for reading volume of hæmoglobin.

instruments. This is done by capillary attraction. By means of the large pipette filled with water the contained blood is washed into the reservoir assigned to it. The mixture is carefully stirred to secure thorough homogeneity. More water is added until the compartment is filled, care being taken that the surface of the fluid is level, and that there is neither a concave nor a convex lemniscus. The remaining compartment is next filled with plain water, the surface of which must also be without a lemniscus. Artificial light (candle, oil or gas) is necessary; sunlight or electric light will not do for the purpose of illumination. The com-

partment containing the plain water overlies the wedge, which is moved along until the shade presented corresponds with that of the blood mixture, and the reading is taken as already stated. The examination must be made in a dark room.

The Hæmatocrite.—Centrifugal force for the examination of the blood was first proposed by von Heden, who designed the hæmatocrite now known by his name. In this country we may use with greater advantage the centrifuge perfected by Metzger, of Philadelphia, under the supervision of Judson Daland (see Fig. 35, page 351). With this instrument one may attain as high a speed as 25,000 revolutions per minute, although this is rarely necessary. With the centrifuge there come two blood tubes, having a capillary bore, and graduated into 100 divisions, which are set in a cross-bar when subjected to centrifugal action. With this instrument it is not necessary to mix the blood with an equal volume of a $2\frac{1}{2}$ per cent. solution of potassium bichromate as recommended by most authorities, as the speed attainable is sufficient to separate the constituents of pure blood.

When the instrument is put in action, the red blood-corpuscles being of greater specific gravity than the other constituents go to the periphery; the white blood-cells are next in order; the serum being the lightest takes a position at the innermost extremity of the tube. By means of the graduations on the tube one can read off the volume percentage of each constituent. In healthy blood the red blood-cells take up from 40 to 60 per cent. The white cells take up about one volume; and the serum the balance. Control tests made with the Thoma-Zeiss apparatus show that each volume on the scale of the hæmatocrit corresponds to 99,390 red blood-cells (Osler); one volume of white blood-cells represents many fewer cells than of the red, because these corpuscles are of larger size. The hæmatocrite is, then, a valuable instrument for the rapid estimation of the cellular elements of the blood—an important desideratum for a busy practitioner.

The great objection to the hæmatocrite for blood examination lies in the fact that in certain diseases the size of the blood-cells is greatly diminished; hence in such cases the volume percentages are unreliable guides as to the number of corpuscles present; particularly does this remark apply to pernicious anæmia. In leucocythæmia, however, it is invaluable as enabling one in an incredibly short time to demonstrate the relative proportions of white and red blood-cells. With further experience in the use of the instrument, and additional improvements in its mechanism, the value of the centrifugal method will undoubtedly increase.

Ehrlich's Method of Examining Dried Blood Specimens.—It has been demonstrated that the granular matter of the white blood-corpuscles react differently to certain stains, thus suggesting that the compo-

sition and therefore the functions of these structures are not identical. Ehrlich's studies of these bodies have afforded us an invaluable means of diagnosing the early stages of leucocythæmia; and it is more than probable that increased experience will afford us additional knowledge respecting the histology of the blood.

Recognizing that the granular matter of the protoplasm of the white blood-cells exhibited remarkable differences in their staining properties, enabled Ehrlich to distinguish five varieties of what he called granules, which he classed as A to E granules. His method of examination is as follows: A drop of blood is spread out between two cover slips, which are handled with forceps, because the moisture of the fingers is capable of altering the shape of the corpuscles. The cover glasses are then separated and the specimen allowed to dry in the air. If necessary the specimen may now be set aside for examination at leisure. It is finally dried upon an exsiccator or heated upon a plate of copper foil at a temperature of 120° C. for several hours. This fixes the hæmoglobin of the red corpuscles. For this operation a drying chamber for temperatures beyond 100° C. is very useful. Von Jaksch suggests that the specimen be hardened with absolute alcohol, in which case the alcohol must be driven off by evaporation before staining. Next the preparation is stained with a saturated eosin-glycerin solution, the surplus stain washed off, the preparation dried and mounted.

The granules recognized by Ehrlich as present in the human body and possessing clinical value are: (1) The eosinophilic or α-granulation. These stain with acid pigments, *e. g.*, eosin. The methods for their detection have just been described. (2) Basophilic or β-granulation, which stain with basic dyes, dahlia, gentian-violet, methyl-violet, etc. (3) Neutrophilic, or ϵ-granulation, which is found in the majority of leucocytes, and requires for its staining the following fluid: "To five parts of a saturated solution of acid fuchsin one part of a watery solution of methyl-blue, and five parts of distilled water are added; the mixture is allowed to stand for some days; then filtered, and the filtrate may be employed for staining specimens as already indicated. The granules are stained a dense violet.

The varieties of white blood-cells present in health are as follows, (quoting from Osler):

"(1) *Lymphocytes.*—Small cells about the size of red blood-corpuscles, containing large roundish deeply staining nuclei, the non-granular protoplasm appearing only as a little rim around the nucleus. These are derived from the lymphoid tissues of the body, and make up 20 or 30 per cent. of the whole number of leucocytes in the blood.

"(2) *Large Mononuclear Forms.*—Cells with a large oval or ovoid feebly staining nucleus, and a relatively well-developed protoplasm which does not contain granules. Ehrlich believes that they are not gradually transformed in the circulating blood into the smaller polynuclear forms.

"(*c*) *Leucocytes with Polymorphous Nuclei* (the so-called polynuclear leucocytes).—This is the most common form, since they represent two-thirds of the whole number of white blood-corpuscles. They are smaller than the large mononuclear elements, and are characterized by the irregular forms of their nuclei, which take all sorts of shapes—S, V, Y, *Z* or E. Their protoplasm is thickly studded with fine neutrophile granules, so that they are often called polynuclear neutrophiles.

"(*d*) *Transition Forms.*—These cells are similar to the large mononuclear corpuscles, but differ in having indentations in their nuclei. Ehrlich regards them as intermediate forms between *b* and *c*. The mononuclear cells, together with these transition forms, represent about 6 per cent. of the whole number of leucocytes in normal blood.

"(*e*) *Eosinophiles.*—These are cells of about the size of the polynuclear leucocytes with variable nuclear forms, and a protoplasm containing large refractive eosinophilic granules. They make up from 2 to 4 per cent. of the white blood-corpuscles, and have their origin probably in the bone-marrow. Forms *b*, *c* and *d* are said to come from both spleen and bone-marrow.

CHLOROSIS.

Synonyms.—Green sickness; morbus virgineus.

Definition.—Chlorosis is a form of anæmia occurring for the most part in girls during the period of beginning sexual activity, and characterized by diminution of the corpuscular richness in hæmoglobin.

Etiology.—Of the predisposing causes of chlorosis, age and sex stand forth with especial prominence, so much so indeed that if the suspected case occurs in a male subject, or in one not of the favoring age, the diagnosis should be subjected to a most rigid scrutiny. The disease is practically limited to young women. Still it may occur in the male sex, though with nothing like the frequency at one time admitted. Age is scarcely less important as an etiological factor than sex, as it attacks girls ranging in age from the fourteenth to the twentieth years. Cases undoubtedly occur at a more advanced period of life, but inquiry usually elicits the fact that the patients had suffered from the disorder in previous years. Usually the symptoms are first manifested about a year or thereabouts after the first appearance of the menstrual flow. In some instances hereditary influences are important, for the disease has been observed to run in families. It has been suggested, however, that in these cases, the family predisposition has been occasioned by exposure of the patients to similar habits which may have served as exciting causes. Allowing for this opinion, there can be no doubt of the fact that there are some cases in which heredity alone exerts an important causative influence. There seems to be no special character of constitution predisposing to chlorosis. It is a general belief, to which Osler gives his

adherence, that girls with light hair and a fair complexion are the more frequently attacked. While this may be true as a comparative statement, too much dependence must not be placed upon it, for brunettes are by no means infrequently afflicted. The disease is also said to occur in those naturally delicate; but here again we have a statement by no means without numerous exceptions, for many cases have occurred in girls hitherto in possession of most robust health. It may occur in the stout or the thin, in the tall or in the short. Jolly has contended that families subject to tuberculosis are predisposed to the disease under consideration.

Virchow believes that in some cases, at least, chlorosis is the result of developmental errors, and that its foundation is laid at birth. He observed an abnormal narrowness of the aorta and of its branches in many cases. This cannot be a necessary cause, however, for many cases of this arterial anomaly occur in persons in the possession of excellent health.

Some cases seem to have a neurotic origin. Such are those in which the disease has appeared as an apparent result of emotional influences, such as fright, disappointed love, and other emotions. The theory that chlorosis results from unsatisfied sexual desire is sadly in need of confirmation, for it may occur in young married women as well as in others. Its only foundation, in fact, lies in its frequent occurrence among young women at a period of life when sexual activity is about to begin. It is a theory that cannot be too severely condemned, tending as it does to the recommendation of marriage as a therapeutic measure. Undoubtedly the demands of modern social life are important predisposing factors. Young women are altogether too prone to neglect all the laws of hygiene. They form indolent habits, read sensational or erotic novels, live in close rooms, keep late hours, dress improperly, eat irregularly, and neglect their bowels. The last mentioned was regarded by Sir Andrew Clark as of pre-eminent importance, so much so indeed, that he proposed that chlorosis should be called "fæcal anæmia." He claimed that all of the symptoms of the disease could be a sequence of fæcal absorption. There can be no doubt of the importance of this factor, but it does not explain all cases. I have, at present, under treatment a young lady of eighteen years with a characteristic chlorosis, who has never had a marked constipation. No social scale is exempt. The wealthy classes are exposed to the influences just enumerated, while the poorer are forced to subsist on food improper in quality or deficient in quantity, and work from daybreak to sunset in crowded, illy-ventilated workshops, which no intelligent community should tolerate.

It is very doubtful if chlorosis ever results from other acute or chronic diseases. Cases alleged to be of this character are really examples of secondary or symptomatic anæmia.

Pathology and Morbid Anatomy.—The opportunities for pathological research are necessarily very limited, because of the rarity with which this disease results fatally. Virchow's observations relating to the small size of the aorta and its branches in many cases, have been referred to. This condition cannot be any other than an associated one, however, for if it were a causative factor it is hardly likely that chlorosis would be as amenable to treatment as it is. So far the pathology of chlorosis must be regarded as an enigma. Whatever theory is accepted must explain the occurrence of the disease in women at the age of beginning functional activity of the sexual organs.

Symptomatology.—The onset of chlorosis is nearly always slow. Cases are, however, observed in which the symptoms appear and progress rapidly, so that all the phenomena of the disease become well marked within a few weeks. As to the symptoms which first attract notice and call for relief, we may say that they vary in different cases. Sometimes it is a general lassitude, sometimes amenorrhœa, headache, cough, pallor, dyspnœa on slight exertion, and many others of considerable variety.

The pallor in chlorosis is, as a rule, better marked than in other varieties of anæmia owing to the deficiency in the coloring matter of the blood. It shows itself as a characteristic greenish-yellow tinge, to which the disease owes one of its popular names, "the green sickness." The palpebral conjunctivæ participate in the general pallor. Indeed, an examination of these parts constitutes a ready means of recognizing the anæmia. The matrices of the finger-nails are likewise pale. The patient is generally apparently well-nourished and is plump; indeed, she may be stouter than normal. The cheeks often exhibit a well-marked flushing under excitement, this reddish tinge standing forth in marked contrast with the pallor of the rest of the body. The explanation of this phenomenon is found in the relatively large size and superficial position of the cutaneous vessels of these parts, which naturally brings about a relatively large vascular supply, which increases under the stimulus of any excitement. The preservation of adipose tissue is an important feature of chlorotic cases.

Dyspnœa, syncope, and palpitation of the heart, are phenomena of many cases. They are due directly to the changes in the blood, the oxygen-carrying property of which is decidedly impaired. Although suggestive of cardiac disturbance they are not in any way dependent upon disease of the heart. In some cases the actual quantity of the blood is increased, thus throwing additional labor on the heart, which under the increased labor thrown upon it undergoes dilatation. This latter condition, however, disappears on the removal of the abnormal changes in the blood. The inability to withstand exertion is likewise dependent upon the deficient oxygenating power of the blood. The

patient may be able to undertake violent momentary exertion, but inasmuch as restoration of the muscles for continued exertion requires a liberal supply of oxygen, their power of endurance is decidedly limited. Chlorotic patients are ofttimes decidedly whimsical in their actions. Thus they may in response to the general lassitude occasioned by the causes just enumerated, lead a lazy life, especially when the demands made upon them call for actions distasteful to them, and yet at the call of pleasure they rouse themselves into a state of activity, of which they had previously seemed incapable.

Auscultation of the heart discovers, in very many cases, the characteristic anæmic murmur. These murmurs may be heard at any of the orifices, but are especially prominent at the second costal cartilage or the third interspace on the left side. Their character is soft, their pitch low, and their time systolic. They may be associated with the venous hum, the "bruit de diable." To detect this phenomenon a double stethoscope is especially valuable. It should be applied to the neck on the right side, near the clavicle and behind the sterno-mastoid muscle. The murmur is then heard as a continuous hum, which has been compared to the sound of a top. Pressure of the finger on the vein above the stethoscope causes the sound to disappear.

The pulse differs in no particular from that of other varieties of anæmia. It is small and compressible. Very slight influences cause it to become rapid. In some cases the circulation is sufficiently sluggish to bring about œdema of the ankles. Brayton Ball has directed attention to venous thrombosis as a complication of chlorosis. Either the brachial or femoral veins or the longitudinal sinus may be involved; accident to the latter being especially serious.

Chlorotic patients present various phases of mental character. In some cases they are unusually bright and vivacious, but more frequently are dull and lethargic. In many instances they are decidedly hysterical and subject to remarkable changes in mood and temperament.

Gastro-intestinal symptoms are often present. The patient may exhibit abnormalities of appetite as fickle as the hysterical mental state. Ordinarily there is but little desire for food, or the patient craves articles of the most indigestible or innutritious character. Thus, she may devour pickles and like articles, while she spurns nourishing food. It may even happen that she exhibits a craving for absolutely indigestible substances as slate-pencils, chalk and even earth. Vomiting is sometimes observed and is especially apt to take place in the morning. This phenomenon, taken in conjunction with the previously mentioned insane appetite and the amenorrhœa to be mentioned shortly, may lead to the suspicion of a possible pregnancy. Dilated stomach has been discovered in some cases and may be either a cause or a result of the blood condition. As regards the power of digestion, the patient's ability to digest fats is lost early in the disease; next, she exhibits a loathing for meats.

The bowels are constipated as a rule, and to an extreme degree. There is formation of large quantities of flatus.

The headache is sometimes a very troublesome symptom, indeed the one for which the patient seeks relief. It is usually situated in the vertex.

Menstrual disturbance is not uncommon. Sometimes it consists of amenorrhœa, which is wrongly interpreted by the mother to be the cause and not a symptom of the blood state. In other cases there is menstrual irregularity, and in still others menorrhagia.

As a rule the temperature is normal. Cases running a febrile course are to be regarded as possessing serious features.

Examination of the Blood. An examination of the blood affords a positive means of diagnosing chlorosis. The characteristic feature is a diminution in the percentage of hæmoglobin, while the red blood-cells are but slightly diminished in number. Thus the hæmoglobin may be but 25 per cent. of the normal standard, while a count of the corpuscles gives about three and a-half millions to the cubic millimetre, or about 75 per cent. of the normal. The white blood-corpuscles are only slightly increased in number, bearing a ratio to the red of about 1 : 400.

Microscopically the individual blood-cells are seen to be paler than normal, and are sometimes distorted, presenting flask-like or hammer-like appearances. Some have claimed that the alkalinity of the blood is diminished.

Diagnosis.—The diagnosis of chlorosis is, of course, readily made by the presence of the history already given. It may happen, however, that grave forms of anæmia, or anæmia secondary to other diseases, may arise and fail of recognition. A diagnosis of chlorosis can then only be assured when the blood examination shows the characteristic alterations already described, and careful physical examination proves the absence of such organic diseases, *e. g.*, Bright's disease, phthisis and hæmorrhage, as may produce marked anæmia.

Prognosis.—This is almost certainly favorable, a cure always resulting excepting in those cases complicated by serious changes in the vascular system.

Treatment.—The successful treatment of chlorosis demands attention to both medicinal and hygienic details. Regarding the latter, it will be found advisable in the majority of mild diseases to insist upon a life in the open air, with a certain amount of exercise. Severe cases, on the other hand, require considerable rest; in some instances it may be necessary to place the patient under a systematic rest cure with overfeeding and massage. The diet should be highly nutritious. It should consist as far as possible of albuminous food, and the patient should make it a rule to take some light nourishment, as milk, between meals.

Fresh air is a valuable adjuvant; it is well, therefore, when circumstances will permit, to send the patient to the country or seashore. The greatest attention should be paid to the bowels, if constipation coexists, remedying this evil by hygienic measures, and not by purgation.

As to the remedies useful in chlorosis, iron stands pre-eminent. Useful as it is it must not be regarded as a universal specific. It is, however, the remedy which will be found indicated in the majority of cases, and as Hughes as shown, is homœopathic to the disease. Most physicians find it necessary to give rather large doses of the drug, *i. e.*, one grain dose of the crude or the first decimal trituration of *ferrum redactum.* Some advise Blaud's pill. The symptoms of ferrum show a wide applicability in this disease. We may note especially the pale waxen or earthy hue to the skin, sudden flushing of the cheeks under slight excitement, gastralgia, heavy pressure in the epigastrium, pallor of the mucous membranes, aversion to meat, profuse menstruation, general chilly feelings, palpitation of the heart, œdema of the feet, throbbing of the bloodvessels all over the body, headaches, and vertigo. *Pulsatilla* is adapted to many cases of chlorosis. It is especially indicated when the characteristic mental condition of that remedy is present. The patient complains of feeling chilly and yet finds relief in the open air. When pains are present, they are apt to be accompanied by chilliness. Menstruation is scanty. *Graphites* should be prescribed for chlorotic patients who are possessed of a rough, harsh, dry skin with but little tendency to sweat. Constipation is apt to be obstinate. Menstruation is delayed and scanty. Some severe cases which do not yield to ferrum require *arsenicum,* especially when debility is marked and œdema is present. Gastric irritability affords still another indication for the use of arsenic. Other remedies which may prove useful are *sepia, calcarea carb.,* and *alumina.* In every case too much must not be expected of medicines in the absence of attention to proper modes of living.

PROGRESSIVE PERNICIOUS ANÆMIA.

Synonyms.—Idiopathic anæmia; essential anæmia; essential febrile anæmia; Biermer's anæmia.

Respecting nomenclature, the term "progressive pernicious anæmia" while in common use, is not precisely correct, for some cases do recover and others improve only to relapse from time to time. Essential anæmia is probably more appropriate, as it does not necessitate an absolutely unfavorable prognosis, and the word "essential" signifies the independence of the blood changes of any visceral lesions.

Definition.—Progressive pernicious anæmia is a form of anæmia occurring independently of any disease of any of the viscera and characterized by certain changes in the blood. These latter consist of diminution in the number of red corpuscles which also exhibit alterations

in shape and size, changes in the composition of the plasma, lessened coagulability of the blood, and deficient hæmoglobin, although never to the extent which the destruction of red blood-corpuscles would lead us to expect.

History.—Although isolated cases of a fatal anæmia were reported by several observers as far back as the early portion of the present century, the disease under consideration received no special notice until described by Addison in 1855, and even then mainly in England. Channing, in America, had reported a case as early as 1832, and it is evident that his colleagues were familiar with pernicious anæmia at that time. In 1872 Biermer published his extensive monograph in which he proposed the name "progressive pernicious anæmia" as the most appropriate. His dissertation added much to the already existing knowledge, but still his claim of priority of description was untenable. His writings did considerable toward making knowledge of the disease universal. Since his time, further contributions to the literature of the subject have been made by Pepper, Osler, Quincke, Pye-Smith, Bramwell and Mackenzie.

Etiology.—The predisposing influence of age and sex so marked in chlorosis is not found in pernicious anæmia. The disease seems to occur with about equal degree of frequency in the two sexes, some observers contending for preponderance in male subjects (Osler) and others for preponderance in females (Zenker, Biermer and Gusserow). It is a disease of young adults, the majority of cases occurring between the ages of twenty and forty years. It has been observed in children, however, Griffith having collected from literature about ten cases in children under twelve years of age.

The general understanding of pernicious anæmia, that of an essential or idiopathic disorder, naturally makes the etiology of all cases coming under this category either doubtful or impossible of recognition. Cases bearing all the phenomena of the disease have followed pregnancy, and especially in patients in whom a number of pregnancies have succeeded each other at very short intervals.

Grave anæmia has frequently been observed in connection with atrophy of the gastric mucous membrane, and this has led to the suggestion that this lesion is ofttimes the cause of progressive pernicious anæmia. William Hunter believed the disease to be the result of intoxication arising from absorption by the gastro-intestinal mucous membrane. It is not surprising in the case of a disease, the etiology of which is so obscure, that the germ theory should be appealed to for aid. Accordingly we find that Klebs and Frankenhauser have made special claims for micro-organisms named by them "cercomonas globulus" and "cercomonas navicula," and have ascribed to them a pathogenic influence. The claim for an infectious origin finds some little support in the apparently greater relative frequency of pernicious anæmia in certain

countries, as Switzerland. The disease seems to occur more frequently among dispensary than private patients; hence it is not unreasonable to attribute defective hygiene and privation as possessing some influence in its production. In some cases it has followed immediately after loss of blood. Under ordinary circumstances recovery from such an accident is prompt, but in certain instances recovery does not ensue, and the anæmia progresses to a fatal termination.

Pathology and Morbid Anatomy.—Interesting as are the theories proposed to account for the existence of pernicious anæmia, their consideration is out of place at this time, for in the present state of our knowledge they must be regarded as purely speculative. We must, therefore, confine ourselves to a presentation of observed facts, *i. e.*, of the morbid changes found at autopsies. These may be generally stated to consist of blood changes, anæmia, fatty degeneration of different viscera, hæmorrhagic extravasations into tissues and organs, and alterations in the composition of the bone-marrow. The blood changes will be described when speaking of the symptomatology of the disease. The tissues throughout the body exhibit a remarkable bloodlessness. The ordinary amount of subcutaneous fat is present; the fat, moreover, presents a bright or sulphur-yellow color, attributed by Lepine to the presence of a ferrous sulphide. Œdema in various parts of the body is not uncommon. Thus it has been observed in the feet and ankles, the face, or over the entire body. Sometimes accumulations of serum are found in the serous cavities, *e. g.*, the pleura, the pericardium, and the peritoneum. The quantity of effusion, however, is rarely sufficiently large to make its existence recognizable by physical signs during life. Œdema of the lungs constitutes a common condition in the terminal stages of the disease.

The widespread fatty degeneration in pernicious anæmia probably arises secondarily to the blood state. It is noted as especially prominent in the heart, but it affects the kidneys, liver, walls of the stomach and intestines, and the bloodvessels. The fatty degeneration of the heart muscle is sometimes so marked as to be perceptible to the naked eye. It is exhibited as yellow mottlings or striations, and is most marked on the musculi papillares and the columnæ carneæ. The ventricles exhibit more advanced changes than do the auricles. The liver is also fatty, but is normal in size. The intima of the bloodvessels exhibits patches of fatty degeneration.

Minute hæmorrhagic extravasations constitute a very important and very common phenomenon of pernicious anæmia. They are observed with especial frequency in the retina, probably because that portion of the body is readily accessible to examination. At autopsies they have been found in and beneath the serous membranes and in the mucous membranes of the gastro-intestinal and respiratory tracts and in

the bladder. They are sometimes observed in the brain substance. They have been variously ascribed to vascular degeneration, embolism, thrombosis, and diapedesis.

The most interesting change in the liver is the increased percentage of iron found in that organ. In health the normal amount of iron in the liver according to Oidtman is .08 per cent.; but in pernicious anæmia it was found to reach .5187 by Rosenstein and .6 by Quincke. The excessive deposit of iron is also found in other organs, but in much less degree than in the liver. It is manifested as a dark gray staining, especially marked in the outer and middle zones of the lobules of the liver. So far as is known this condition is not found in secondary anæmias. Examinations made by Scott under the direction of Osler makes it appear that this lesion is peculiar to pernicious anæmia. Russell in seven out of forty-four livers examined by him found as marked deposits of iron as in pernicious anæmia. In all of his cases the quality of the blood was seriously impaired. He favors the view that pernicious anæmia is a process common to a number of affections and not an independent disease.

Lesions of the cerebro-spinal nervous system are not uncommon. A general anæmia of these parts is, of course, always present. There may also be observed minute hæmorrhagic extravasations, and in rare instances extensive hæmorrhages. Eichhorst and Müller observed hæmorrhagic pachymeningitis. Minnich and Lichtheim have noted spinal lesions with especial frequency, the former even when the symptoms during life were not suggestive of such a morbid state. These lesions consisted of capillary hæmorrhages, sclerosis of the posterior columns and segmentation of the axis cylinders. The cases, however, in which spinal symptoms are prominent phenomena during life are necessarily limited, and, judging from personal experience, point more particularly to a widely disseminated sclerosis of the cord.

Atrophy of the gastric mucous membrane has been observed by a number of clinicians, but is by no means a constant condition. Submucous hæmorrhages are comparatively frequent.

The spleen and lymphatic glands present no definite condition. The former may be either small, normal or enlarged. The lymphatic glands are usually normal. Changes in the bone-marrow seem to be pretty constant. These have been described as a primary hyperplasia. To use Osler's words, "The amount of yellow marrow is diminished and is apparently replaced by hæmoblastic red marrow." In a case reported by Rindfleisch the marrow appeared to be one huge mass of nucleated red cells, and Rindfleisch is inclined to think the cause of the pernicious anæmia to be an inability of the organism to change the nucleated red cells into the normal non-nucleated red blood-corpuscles.

In closing this review of the pathology of pernicious anæmia we must express our agreement with those authors who hold that the disease

is probably dependent upon a variety of disorders, and that those in which such lesions are absent may be due to the destruction of red blood-corpuscles by toxic substances in the circulation.

Symptomatology.—The first evidences of ill health in pernicious anæmia are those incident to the blood changes and which differ in no-wise from those characterizing other forms of anæmia. The illness is usually of very gradual onset, so gradual indeed that it is hard to say exactly when it began to assert itself. Exceptionally, cases in which the progress is rapid, are observed. The patient becomes pale, and his strength departs. Evidences of deficient oxygenation appear in the shape of breathlessness and palpitation on slight exertion. As the anæmia increases the pallor gives place to a lemon-yellow hue of the skin, which is usually described as characteristic of the disease. Headache, vertigo, and tinnitus aurium become prominent in this as in other varieties of anæmia. The mucous membranes participate in the pallor. The appetite is gradually lost; digestion is impaired, probably because the impoverished blood supplied to the stomach necessitates a lowered standard of nutrition in that organ. Nausea is often present, and is frequently associated with vomiting, which may prove exceedingly obstinate. These symptoms are all present in chlorosis, but in the disease under consideration they attain a much higher degree of intensity than in that comparatively speaking innocent disorder. The anæmia eventually becomes so profound that the patient has not sufficient strength to sit up. If he attempts to do so, syncope occurs. In some cases this symptom is accompanied by spasmodic rigidity of the entire body. The mind is generally unimpaired. All questions, however, are answered in a listless manner in a low and feeble tone of voice.

Considering now the symptoms of the disease *seriatim*, the appearances presented by the blood claim first attention. That fluid presents a marked diminution in the number of red blood-corpuscles; the hæmoglobin is also much decreased, though not usually in full proportion to the loss of the corpuscular elements; the white corpuscles are normal in quantity or somewhat increased. The red blood-cells exhibit remarkable changes in conformation. Some are misshapen (poikilocytosis); others are greatly enlarged (megalocytes or macrocytes); and still others are much smaller than normal (microcytes). The diminution in the number of red blood-corpuscles is extreme in advanced cases; Quincke has reported one in which they numbered but 143,000 to the cubic millimetre just before death; and Wiltschur another in which they were 250,000 to the cubic millimetre. As already stated, the lowering of the percentage of hæmoglobin is never so extreme as the oligocythæmia. Thus in Wiltschur's case the hæmoglobin amounted to 11 per cent. The relatively good supply of hæmoglobin is regarded by many as strongly characteristic of pernicious anæmia. It is certainly sufficiently distinc-

tive to differentiate it from chlorosis in which the reverse condition obtains. Its value is greatly lessened by the fact that instruments for estimating the proportion of hæmoglobin in practice, are so decidedly lacking in accuracy that they cannot be depended upon in determining slight differences. The error possible in von Fleischl's hæmometer (which is generally acknowledged as the best of the class) is stated to be as high as 10 per cent. when dealing with greatly impoverished blood.

Microscopic examination of the blood shows a large number of large blood-corpuscles, which may measure from 10μ to 15μ. These macrocytes constitute an important feature of pernicious anæmia. They are present in other cases; but when found in the proportion of 25 per cent. of the red corpuscles they are regarded by Henry as certain evidence of the existence of pernicious anæmia. It is to their presence that the relatively large proportion of hæmoglobin, in comparison with the number of red blood-cells, has been ascribed. Microcytes, *i. e.*, red blood-corpuscles ranging in size from 2μ to 6μ in diameter are said to be present in pernicious anæmia by Vanlair and Masius, whose observations are quoted approvingly by Osler. Von Jaksch, however, remarks that microcytes are seldom found in the blood in this disease. Marked alterations in the configuration of the red blood-corpuscles have been noted, and are by some regarded as characteristic of pernicious anæmia. The abnormal shapes have been variously described as resembling flasks, anvils, knobs, goblets, etc. Extensive clinical observation proves that they are by no means characteristic of the disease under consideration, for unquestionable cases have been observed in which they were absent; and they may be found in any disease in which the blood is greatly altered and especially when the red blood-cells are diminished in number. The leucocytes are never increased excepting temporarily; on the contrary they may be diminished; usually, however, to but a slight extent.

As already stated when speaking of the pathology of pernicious anæmia, hæmorrhagic extravasations into the submucous, subserous, and subcutaneous tissues are exceedingly common. Retinal hæmorrhages have been observed with especial frequency. Mackenzie says they are almost invariably present. Purpuric spots are often seen. Epistaxis, bleeding from the mouth and gums, metrorrhagia, and cerebral hæmorrhage have also been noticed. These hæmorrhagic symptoms are found in most anæmias, but they are observed with especial frequency in the pernicious variety. Baques has even seen retinal hæmorrhages and œdema in cases of temporary anæmia.

Pyrexia is a very common symptom of pernicious anæmia. Immermann regarded it as diagnostic. It is present in the majority of cases. It is decidedly irregular in its type. Usually the temperature reaches 101° or 102° F., but it may be as high as 104° F. During the pyrexia there is very apt to be an aggravation of all the other symptoms of the disease.

Examination of the heart and bloodvessels reveals the presence of the characteristic venous and anæmic murmurs already described in connection with chlorosis. The throbbing of the large arteries may be visible. A venous pulse was observed by Osler in two cases. A capillary pulse may be visible. Sphygmographic tracings may resemble those of aortic insufficiency.

Sensitiveness of the bones to pressure has been described by most authors. The sternum in particular manifests pain on slight, gentle percussion. Pressure causes pain in the bones of the extremities. In exceptional instances swellings of joints have been observed.

The urine is of low specific gravity and dark in color. The latter is due, as shown by Hunter, to pathological urobilin. In one instance he found it due to normal urobilin. The presence of this large quantity of pathological urobilin is regarded by Hunter as valuable evidence of excessive destruction of red blood-corpuscles. This substance may be detected in the urine by the addition of a few drops of an alcoholic solution of chloride of zinc, which produces a marked green fluorescence. As great as is the importance that has been attached to these urinary changes, their universal presence has been denied. Mackenzie reports having observed numerous cases in which the urine was of a light color throughout the course of the disease; and Eichhorst speaks of dark urine as only exceptionally present.

Hunter also found a marked excess of the aromatic sulphates in the urine in pernicious anæmia. These he ascribed to the presence of "increased but perverted gastro-intestinal activity and absorption."

Spinal symptoms are observed in quite a number of instances. According to Lichtheim and others they are the result of degeneration of the posterior columns; but, as already stated, personal experience teaches that the motor phenomena are those of spastic paraplegia, and hence that the lesions involve, in part at least, the pyramidal tracts.

Diagnosis.—The diagnosis of pernicious anæmia is to be based on the physical examination of the blood, the absence of any indications of disease capable of producing a secondary anæmia, the extreme pallor as evidenced by the yellow complexion, the fever, the hæmorrhagic tendency, and the obstinacy to treatment. The diseases with which it is most likely to be confounded are chlorosis, secondary anæmias, Addison's disease, and chronic Bright's disease with anæmia.

The characteristics of chlorosis are sufficiently distinctive to prevent mistakes. That disease occurs with especial frequency in young women at or shortly after the age of puberty; and its blood changes consist of a greatly lowered percentage of hæmoglobin entirely out of proportion to the diminution in the number of red blood-corpuscles.

In secondary anæmia physical examination usually discovers the existence of some organic lesions to account for the difficulty, these in

most instances consisting of gastric disease, malignant tumors, or phthisis. The skin has not the lemon-yellow tint of pernicious anæmia. The occasional dependence of high grades of anæmia on intestinal parasites must be borne in mind, and careful inspection of the stools advised so that such a condition may not escape observation.

Addison's disease is characterized by pigmentation of the skin, a comparatively mild anæmia, great emaciation, and mental depression, phenomena which are not observed in pernicious anæmia.

The anæmia of renal disease, tuberculosis, and other organic affections should not be confounded with pernicious anæmia if careful attention is paid to the details of physical examination.

Prognosis.—The prognosis of pernicious anæmia is very grave, but few cases recovering. Many instances in which marked improvement in the physical characteristics of the blood has taken place under treatment have been reported. While in many of these the improvement has lasted for a long time, in the majority, relapses ultimately take place. Osler confesses to having seen no case in which the improvement lasted longer than five years, although he quotes Hale White, who reported a case in which the patient enjoyed good health eleven years after cure by arsenic. It is hard to say just what the elements which influence the prognosis are. Naturally, we would expect that those instances in which the oligocythæmia is the most marked offer the most unfavorable prognosis; and yet Quincke's case, in which there were but 143,000 red blood-corpuscles to the cubic millimetre, recovered. A diminution of the corpuscles to below one-tenth of the normal should be regarded with great apprehension. Cases occurring in pregnant women are believed to be especially unfavorable. The occurrence of hæmorrhages and cerebral symptoms is also of grave import.

Treatment.—While the general results of treatment of pernicious anæmia are unsatisfactory, much is occasionally accomplished by medicinal measures. *Arsenicum* especially seems to be the remedy which has thus far done the most good. It should be given in grain tablets of the second decimal trituration, three or four times daily. *Picric acid* and *picrate of zinc* produce symptoms simulating those of pernicious anæmia, and should be borne in mind as possible remedies. Fraser, of Edinburgh, has recently advocated the use of a glycerin extract of red bone-marrow, and reports one case in which remarkable results were obtained by it. When the patient's digestion will permit, the bone-marrow may be seasoned with a little salt, and administered on bread and crackers. In still other cases it may be mixed with hot milk. The question of transfusion of blood is one concerning which diverse views prevail, some physicians looking upon it as positively harmful. There are some who advocate the use of salt infusion, and inasmuch as this operation has been so simplified by the introduction of Northrop's little apparatus

(see page 805), and cannot do any harm, it should be resorted to when other measures fail.

THE SYMPTOMATIC ANÆMIAS.

The symptomatic (also known as the secondary) anæmias include those cases of anæmia arising from loss of blood by hæmorrhage or from alterations in its composition in the course of quite a variety of morbid conditions. Among the latter malignant disease, disorders of alimentation and nutrition, exhausting diseases, as cholera, chronic constitutional disorders, as syphilis and tuberculosis, and certain toxæmias, are especially worthy of note. Notwithstanding the great diversity of causes from which symptomatic anæmia originates, the alterations in the composition of the blood are pretty much the same in all cases. These may be summarized as consisting of loss of red blood-corpuscles and diminution of hæmoglobin percentage in about the same relative proportions. The hæmoglobin is never present in greater quantity than the number of red blood-corpuscles permits as in pernicious anæmia. Exceptionally, the loss of hæmoglobin is disproportionately great, especially, according to Neubert, in tubercular diseases. The number of white corpuscles is always relatively, and sometimes absolutely, increased. The red corpuscles themselves exhibit marked abnormalities in form and size, these changes being particularly manifested in cases in which their numbers are greatly diminished as in extreme secondary anæmia.

(1) *Anæmia from Hæmorrhage.* The forms of hæmorrhage which especially concern the physician are those arising from rupture of aneurisms, inefficient uterine contractions following parturition, menorrhagia, metrorrhagia, ulceration of the stomach and intestines, the rupture of œsophageal varices, hæmoptysis, epistaxis and enterorrhagia. Hæmorrhages into the subcutaneous and submucous structures, and into various organs, as the brain, are more properly classed as extravasations, and do not occasion sufficient loss of blood to produce a perceptible influence on the general system, unless frequently repeated. Extravasations into important organs, as the brain, occasion such severe symptoms that any anæmia which may arise therefrom is slight and apt to be overlooked in the attention to matters of far greater importance.

The occurrence of internal hæmorrhage necessarily presupposes vascular diseases or alterations in the blood pressure or composition of the blood. Increased blood pressure may be temporary or permanent; the former as the result of excitement or exertion, and the latter of arterio-sclerosis, cardiac hypertrophy, or nephritis, or all three in combination. The alterations in the composition of the blood leading to hæmorrhage result from scurvy, hæmophilia, purpura, the malignant fevers, alcoholism and Bright's disease.

The immediate effect of the loss of a moderate quantity of blood is

diminution in blood pressure, which rises again as soon as the bleeding ceases. The effect on the system is, however, more marked. The functional activity of all of the organs with the exception of those engaged in hæmopoiesis is in abeyance, because the remaining blood tends to the active viscera, and this of necessity takes from all others. This explains the lassitude, indigestion and the weak heart persisting after hæmorrhage.

Almost immediately after the occurrence of hæmorrhage regeneration commences. If the patient be in good physical condition, the normal amount of blood may be regained in the course of a week or ten days. The first portion of the process of repair consists in the absorption of water from the tissues, which continues until the normal intravascular pressure is attained. It is this absorption of water from the tissues that produces the pinched face, the parched mouth, and the great thirst following hæmorrhages.

There also occurs after hæmorrhage a moderate degree of leucocythæmia due to the flow of lymph into the subclavian veins from the lymph ducts. The red blood-corpuscles have also been found to diminish somewhat in numbers for a short time after severe hæmorrhage.

In the case of very severe hæmorrhage the lowering of blood pressure is extreme, and is the cause of syncope and death. In non-fatal cases, it continues low, because notwithstanding the contraction of the arteries, the small quantity of blood remaining is insufficient to fill them.

The effect of hæmorrhage on the system depends on the rapidity with which the loss of blood takes place. Rapid loss of blood produces a more profound influence than does a slow oozing. Thus an acute hæmorrhage of three pints may readily prove fatal. Very large quantities of blood may be lost in repeated oozings and yet recovery take place. The constitutional effects in the latter case are sometimes very marked, because the repeated losses demand constant absorption of water from the tissues, maintaining an almost constant hydræmia. The blood is therefore not in a proper condition for maintaining nutrition, and the general health suffers correspondingly.

(2) *Anæmia from Inanition.* Anæmia from inanition may result either from an imperfect supply of food, or from disorder of the function by which nutrition is carried on. Physiological experiments have demonstrated that fasting produces a diminution in the number of red corpuscles, and even of the total quantity of the blood. The nutritive processes may be disturbed by imperfect hygiene, as bad air, overwork, indolent habits, etc., and by disease. Of the latter we have a marked example in cancer of the pylorus and chronic gastro-intestinal disorders.

(3) *Anæmia from Exhausting Discharges.* This class of cases includes anæmias arising from prolonged suppuration, lactation, albuminuria, and sexual excesses. The blood impoverishment is due to the drain on the albuminous constituents of the blood. In most of these

cases the etiology is more or less complicated, and the causes being long-acting, secondary changes in various organs must result. Thus it is not uncommon to observe amyloid disease in old suppurations; during lactation there are important physiological changes taking place; albuminuria is associated with serious kidney disease, which of course means deficient elimination from the blood of certain excrementitious substances.

(4) *Anæmia from Cold.* Long exposure to cold climates, as in high latitudes without proper hygienic conditions, produces a high grade of anæmia in which the red blood-corpuscles may be reduced to as low as 20 per cent. of the normal number.

(5) *The Anæmias of Pregnancy.* During the course of pregnancy severe grades of anæmia may set in. One of these assumes all of the characteristics of the progressive pernicious variety. Another presents the usual features of secondary anæmias. In any case the blood impoverishment requires proper attention, for not only does the condition produce general and local malnutrition, but it increases the tendency to post-partum hæmorrhage.

(6) *Toxic Anæmia.*—Anæmia may arise from poisoning by quite a variety of substances, notably, however, lead, arsenic, mercury, and phosphorus. Lead in particular produces an anæmia as marked as that arising from disease. It is said, too, that long-continued use of the coal-tar products may cause a similar result, although not to a very high degree. Chronic infectious processes, as tuberculosis, syphilis, and malaria, may also bring about extensive corpuscular destruction. In many of these latter cases the pathological state is a complicated one, involving suppuration, and amyloid and visceral changes. The anæmia accompanying the infectious fevers is probably as much dependent upon the concurrent pyrexia as it is upon the organic poison to which the symptomatic totality of the case is due.

Treatment.—In the majority of cases of symptomatic anæmia the treatment must be conducted on the general principles appropriate to the primary affection, disregarding the blood impoverishment. It must consist of the administration of proper remedies and the adoption of hygienic measures designed to increase the standard of nutrition.

The anæmia from loss of blood finds a remedy of unquestioned value in *cinchona*, the mother tincture of which should be administered in doses ranging from five to ten drops at intervals of from thirty minutes to two hours. The same remedy is useful in cases of anæmia secondary to long-standing suppuration, chronic diarrhœas and sexual excesses. *Phosphoric acid* is indicated in chronic cases in which the reaction is unsatisfactory, and especially when the drain has been other than loss of blood. Other remedies of occasional value are *arsenicum album, arsenicum iod., chininum ars., ferrum, ferrum phosphoricum* and *iodine.*

Transfusion of blood has been recommended as a remedy in cases of

anæmia from hæmorrhage. Physiological experimentation and clinical experience, however, have shown most conclusively that the intracirculatory injection of a normal saline solution is far more efficacious. The regeneration of red blood-corpuscles is rendered more rapid, and in some instances has proceeded to an extent sufficient to give the blood more than its ordinary quota of cellular constituents. Elaborate apparatus for the operation of infusion is not necessary, as illustrated by the simple one designed by Northrop. Not only does he recommend infusion for anæmia consequent upon loss of blood, but also for that of cachectic origin or arising from severe drain of diarrhœa and vomiting.



FIG. 58.—NORTHROP'S APPARATUS FOR SALT INFUSION.

The accompanying illustration does not need explanation. The solution employed "is made by dissolving common salt in water at a temperature of 115° to 120°, in the proportion of one heaping-teaspoonful to the pint."

In case of emergency, Northrop declares that he would be willing to use plain hot water from the range rather than to miss the opportunity for infusion. Of course, he prefers the salt solution made in distilled water. The quantity of fluid used should be sufficient to give the pulse a good volume. Care should be taken that the fluid is not introduced too rapidly, one quart in fifteen minutes is about the proper degree of rapidity when the solution is introduced into a vein; in thirty minutes, when introduced into an artery. One of the median veins on the flexor surface of the forearm is preferred for the seat of operation. "Let an assistant compress the arm above the joint, in order to distend the vein as much as possible. Incise the skin over the vein, separate the latter from its surrounding fascia, and secure it at the distal end of the wound by means of an artery clip or ligature. Now pass a ligature beneath the vein at the proximal end of the wound and leave it untied until the canula is inserted. Hold up the vein by means of the clip or ligature at the distal end, and make a longitudinal slit in its wall large enough to easily admit the canula; insert the latter and tie the ligature above mentioned around the vein and canula together. The operation

is now completed, and the current of salt water should be immediately started."

LEUCOCYTHÆMIA.

Synonyms.—Leukæmia (Virchow); white blood disease.

Definition.—Leucocythæmia is a disease of the blood characterized by the usual symptoms of persistent anæmia, and associated with increase in the white, and decrease in the red blood-corpuscles, together with morbid changes in the spleen, lymphatic glands and bone-marrow, singly or combined.

History.—The first authoritative mention of this disease in medical literature seems to be that of Bennett, who in October, 1845, reported a case as "suppuration of the blood independent of inflammation." While recognizing the increase in the number of the white blood-cells, and the enlargement of the spleen and lymphatic glands, he failed to attach proper importance to these changes. One month later, Virchow reported his first case of the disease and proved that the essential blood change was an increase in the white blood-cells. He proposed the name "leukæmia" for the affection. This, however, is etymologically inexact, and is by no means as good a designation as the one proposed by Bennett six years later,—leucocythæmia or white cell blood. Fuller, in 1846, and Vogel, in 1849, demonstrated the increase in the white blood-cells during life. In 1851 Bennett published an analysis of a collected series of cases, at which time he proposed the name leucocythæmia. Virchow described two forms of the disease: One characterized by the presence of smaller leucocytes in the blood and associated with enlargement of the lymphatic glands; and the other, by the appearance of large white blood-cells, and associated with marked increase in the size of the spleen. To these Neumann has since added a third variety, characterized by marked changes in the bone-marrow, and which he called myelogenous leukæmia. Pure examples of this variety are practically unknown, only one such case having been recorded in literature. The majority of examples of leucocythæmia are associated with splenic, lymphatic and myelogenous changes. Cases of a purely lymphatic type are observed with comparative frequency.

Etiology.—The most careful investigation of cases of leucocythæmia have failed utterly to furnish us with any reliable data respecting the etiology of the disease. Of late years the theory that it is of microbic origin has been very strongly entertained. While the data suggesting that leucocythæmia is an infectious disease are of more than ordinary interest they are by no means conclusive. Thus far bacteriological investigations have added nothing definite to our store of knowledge. Klebs, Bramwell, Majocchi, Bicchini, Kelsch and Vaillard, have each described micro-organisms present in individual cases; but as to the

physical characteristics of these no two observers agree. Inoculation experiments have failed to reproduce the disease.

The occasional occurrence of leucocythæmia in subjects who have been closely associated with patients afflicted with this disease suggests very strongly that it may be contagious, especially so as the rarity of the affection makes it improbable that two cases in the same household can be a mere coincidence. On the other hand, however, inoculations performed with blood taken from leucocythæmic patients have given negative results.

A large number of cases have been known to follow closely upon stomatitis and ulcerative affections of the intestinal tract. It is believed, and with very good reason, that these affections exert an important etiological influence, as they may afford a suitable avenue by which the hypothetical infection may enter the system. It would seem irrational to believe, however, that lesions of the mouth and intestinal canal should be the only avenues of entrance of the infection, unless the micro-organism is one especially liable to thrive in these localities. The lesson taught by the theory of the infectious origin of leucocythæmia is none the less important if it be proven false, for cleanliness of the mouth is an important point in the management of all diseases and a necessary means of preserving health.

Syphilis and malaria seem to play but a small, if any, part in the production of leucocythæmia. Gowers, it is true, observed that a malarial history existed in one-fifth of his collected series of cases; but against this may be urged the great frequency of malarial fevers and the rarity of the disease under consideration. Syphilis is not known to have apparently caused leucocythæmia in any case. It is, of course, possible that specific lesions of the blood-forming organs may give rise to leucocytosis of so extreme a character as to make the existence of leucocythæmia a matter of serious consideration.

About two-thirds of the cases occur in male patients. Birch-Hirshfeld's cases gave 135 males, and 65 females. Osler out of 18 cases, had 11 in male subjects. These statistics suggest the improbability that pregnancy exerts an important influence as an etiological factor.

Leucocythæmia may occur at any period of life. The majority of cases, however, occur between the ages of thirty and fifty years. The youngest subject reported was eight weeks of age; and Osler has observed it in an infant of eight months, Trousseau in one of fifteen months, and Mosler in one of sixteen months. Old age is also liable, Vidal having reported a case in a patient sixty-nine years of age. Of eleven cases which I have seen, sex was about equally divided, and the youngest was sixteen when attacked.

It is also a matter of observation that the majority of reported examples of leucocythæmia have come from the lower and middle classes;

but this is hardly proof that social and sanitary conditions constitute important especial factors in the production of the disease, for such patients are very liable to seek relief at hospitals and dispensaries where they come under the care of clinicians who contribute very largely to the building up of medical literature. Still it is not unreasonable to suppose that poor food and bad sanitation must act as predisposing factors when the subjects thereof are exposed to the exciting causes of this as of other diseases.

Race appears to be utterly without influence. Climate likewise is unimportant, for the disease occurs with great rarity in all countries.

When leucocythæmia occurs in women, there has apparently been some relation to disordered sexual functions. In several instances it has followed repeated pregnancies ; in still others it has occurred during the climacteric. So far as the latter is concerned, it is worthy of note that the disease as occurring in men, appears very frequently at about the age of forty-five or fifty ; hence it is not improbable that in women at that time of life, it exists as a matter of years rather than as a consequence of the disorders incidental to change of life.

Traumatism affecting the spleen has been assigned as the cause in quite a number of instances. Ebstein, however, believes that in some of these cases at least, the leucocythæmia is the result of the chronic nervous changes excited by the injury. Osler, however, looks upon the possibility of traumatism as a cause as exceedingly problematical.

The pre-existence of certain infectious diseases, such as typhoid fever, pneumonia, variola, acute rheumatism, etc., has been discovered in a number of instances, but there is insufficient evidence that the etiological relation is of much importance.

Heredity can be occasionally traced. Cameron reports one case in which the mother, grandmother, and one brother also had the disease, although she, herself, bore three non-leucocythæmic children. Sanger has observed one case in a child born of a perfectly healthy mother.

In several cases exposure to cold has been assigned as the cause.

Leucocythæmia has been observed in the lower animals, notably in dogs, horses, oxen, swine, cats, and mice.

Pathology and Morbid Anatomy.—Two views respecting the pathology of leucocythæmia prevail. One, and this is the more popular, claims that it is a disease of the blood-forming organs ; the other, that it is primarily a disease of the blood, all other changes being secondary.

Of the organic changes, those involving the spleen are the most important and have attracted the most attention. This organ is always enlarged, its weight ranging from one to eighteen pounds, the average weight being about six pounds. The changes seem to be distributed about evenly throughout the organ, for it is found to preserve its normal

shape. As a rule the surface is perfectly smooth. Occasionally there is observed every evidence of an old perisplenitis, the peritoneal covering of the spleen exhibiting opaque yellow patches; at the same time there are found numerous adhesions of the organ to the diaphragm, abdominal walls, stomach, omentum, intestines and liver. The consistence of the organ may be either increased or diminished, usually, however, the former. Section of the spleen shows it usually to be firm and tough, and the cut surface of a reddish-or purplish-brown. Sometimes it is brownish-yellow, interspersed with yellowish lines, these latter being due to thickening of the trabeculæ. Hæmorrhagic infarctions may also be observed throughout the entire viscus. These may exhibit themselves as rusty, reddish-brown, or yellowish-white, caseous areas, when old; and bright-red when recent. Sometimes grayish-white lymphoid tumors are found throughout the splenic substance. In the majority of cases the Malpighian bodies are not prominent; in cases in which lymphatic involvement is an early feature they may be considerably enlarged, so much so as to constitute small tumors.

The cases in which the consistence of the spleen is diminished are generally those in the early stage of the disease. The pulp of the organ is increased, as are also the cellular elements. In some of these cases the spleen may rupture from undue distention with blood.

In all instances the arteries and veins at the hilus are enlarged.

Chemical analysis has discovered glycocoll, hypoxanthin, xanthin, leucin and tyrosin in the spleen.

Changes in the lymphatic glands, though by no means as marked as those in the spleen, are pretty constant. They are more or less enlarged; usually, however, not to an excessive degree. The changes are rarely universal. The tendency to involvement is said to be about in the following order: the mesenteric, cervical, inguinal, axillary, retroperitoneal, thoracic, portal and iliac. In consistence they are usually soft and present a smooth outline to the touch. They are readily movable, not being bound down by a periadenitis. On section they are gray or reddish-white, and hæmorrhagic extravasations are often visible. Microscopically their structure does not differ materially from that of health. Their reticular structure is rarely increased, thus presenting an important distinction from lymphadenoma.

The bone-marrow is altered in the majority of cases; Neumann says in every case, but other pathologists have observed examples of leucocythæmia in which this structure was perfectly normal. The changes are especially marked in bones possessed of a cancellated structure, as the vertebræ and ribs. The marrow is observed to present a puriform appearance. Microscopically, there are observed an increase in the lymphoid cells and the presence of many nucleated red blood-corpuscles. Sometimes there are hæmorrhagic infarctions. The compact

structure of the bones is sometimes thinned; and Mosler has met with cases in which it has been perforated. Occasionally there may exist swellings of the bones here and there.

Numerous structures throughout the body which under normal circumstances contain lymphoid elements also exhibit changes. Thus they are found in the thymus gland, the tonsils, the lymph follicles of the tongue, pharynx and mouth, and in the solitary and agminated glands of the intestines. The tonsils are sometimes enlarged. The lymphoid tissue of the walls of the stomach may also exhibit changes. Sometimes these proceed to ulceration. The gums are often swollen, owing to infiltration with lymphocytes.

The liver is enlarged in probably two-thirds of all cases. In one instance observed by Welch it weighed over thirteen pounds, and even greater enlargements have been reported. When the enlargement is but slight the only observable change consists of hyperæmia. In extreme cases the substance of the organ is interspersed with lymphoid growths between the hepatic lobules. The capillary vessels are greatly distended. Sometimes the liver-cells are found to be undergoing fatty degeneration.

The kidneys exhibit changes scarcely less frequently than does the liver, being involved in about half the cases. In a general way the pathological appearances are the same as those observed in the liver. Sometimes they exhibit the appearances incidental to the anæmia. In others they are enlarged from granular degeneration, distention of the capillaries, or from minute lymphoid growths between the tubuli. They may undergo fatty degeneration.

The heart substance may likewise present granular and fatty degeneration. Hæmorrhagic extravasations may be observed beneath the peri- and endocardium. The capillaries are distended with leucocytes. The cardiac walls are soft to the touch. The organ itself is displaced slightly upwards.

The cavity of the heart contains an unusually large quantity of clotted blood, which in one case amounted to over 600 grammes. These clots have a peculiar color, which has been compared to the color of the fat of the turtle.

The lungs are sometimes found to contain lymphoid growths. Their capillaries are also distended with leucocytes. Hæmorrhagic infarcts are not uncommon. Sometimes the lymphoid tumors ulcerate and form cavities.

Multiple cerebral hæmorrhages are occasionally found.

In case of acute leucocythæmia the enlargement of the lymphatic glands is decidedly more prominent than in the chronic form of the disease.

Symptomatology.—The symptoms of leucocythæmia are of slow onset. Usually the first evidences of the disease are found in a gradually

increasing pallor and the ordinary phenomena incidental to anæmia, as dyspnœa on slight exertion and palpitation. In other cases, however, subjective discomfort is in abeyance, the patient not regarding himself as ill until he discovers a large tumor in the left side. This tumor is, of course, the enlarged spleen, which usually attracts attention by localized tenderness. When it is very large it makes itself felt by a sense of distention and dragging. By upward pressure it may displace the heart, producing disturbed action of that organ and increasing the dyspnœa caused by the impoverished blood. Sometimes spontaneous pain is present. In some cases the abdominal distention is so great as to produce lines over the region of the tumor similar in character to those often found in pregnancy. In still other instances the enlarged spleen gives rise to but little inconvenience. On palpation it makes itself known as a large, hard, smooth tumor, movable beneath the fingers during respiration. In extreme cases it may extend to the umbilicus and even into the right iliac fossa. Sometimes a friction fremitus is perceived, and on auscultation a "splenic souffle," which is systolic in time, is heard. The latter is a rare phenomenon. As already stated, the shape of the spleen is but little altered, which may readily be made out by palpation, the inner edge of the organ being sharply defined and marked by one or two notches. The size of the tumor varies from time to time. It is increased after meals and diminished after hæmorrhage or attacks of diarrhœa.

Gastro-intestinal symptoms also occur early in the course of leucocythæmia. Some cases are preceded by dysenteric phenomena. As a rule the appetite is greatly impaired; exceptionally it is voracious, notwithstanding which the patient emaciates rapidly and progressively. Eating causes discomfort; vomiting and nausea are far from uncommon. Diarrhœa is often present; the stools are thin and watery and are attended by considerable tenesmus. This latter symptom has been attributed to involvement of the lymph follicles in the intestines.

Hæmorrhages from different portions of the body constitute an important symptom. Profuse and persistent epistaxis, which may proceed to a fatal issue, is sometimes observed early in the disease, when the true nature of the disorder is not even suspected. Retinal hæmorrhages are discoverable by the ophthalmoscope. Hæmorrhage from the stomach, bowels, uterus and lungs, and extravasations into the brain, skin, joints and peritoneum, have all been observed. As a rule, this symptom appears only when the disease has caused marked deterioration of the general health. Small wounds, such as are often occasioned by the scratch of a needle or the extraction of a tooth, are apt to bleed persistently. This fact is of great practical importance, for it explains the cause of death in most of the cases in which splenectomy has been practised for the cure of the disease.

The lymphatic glands are generally enlarged, though never to the

extent observed in lymphadenoma, or Hodgkin's disease. In some cases they are perfectly normal to all outward appearances. The enlargements of the cervical, axillary and iliac glands are self-evident. Those of the peritoneum may sometimes be discovered by careful palpation. In leucocythæmia of the pure lymphatic type, the glandular enlargement is greater than in other cases and is associated with less marked involvement of the spleen. The size of the enlarged glands often diminishes just prior to death.

The changes in the bone-marrow, and in the structure of the bones themselves, rarely give rise to symptoms attracting attention. There may be some slight pain in the bones, especially in the sternum, increased by pressure or percussion. Still, this pain may be absent when the marrow changes are extensive. Swellings or irregularities of the long bones are sometimes observed.

Physical examination often discovers the existence of some enlargement of the liver. This rarely gives rise to direct symptoms. Jaundice is sometimes present, but is the result, in most instances, of pressure of enlarged glands upon the bile-ducts. It has also been attributed to the failure of the impoverished blood to destroy the bile pigment absorbed from the intestine.

Circulatory symptoms are pretty constant, though not usually prominent. The dyspnœa resulting from the altered blood and the pressure of the enlarged spleen upon the heart have already been mentioned. The heart is found displaced upwards about one interspace. The pulse is frequent and of low tension, but large in volume. Œdema of the feet is common in the last stages of the disease.

Localized dropsies are sometimes present, but are the result of pressure of enlarged glands upon certain vessels. It is thus that we explain the ascites and the hydrothorax so often encountered.

There is an increased temperature in the majority of cases. The fever, however, possesses no regular type. Usually the maximum temperature is reached in the evening, and ranges from 101° to 104° F. Even the febrile cases may be characterized by long intervals, during which the temperature remains at the normal point.

The nervous symptoms of leucocythæmia are by no means characteristic. They consist of headache, vertigo and fainting, all of which may accompany any form of anæmia. The tendency to intracranial hæmorrhage may lead to sudden attacks of coma, followed by hemiplegia.

Retinitis is a very common symptom of leucocythæmia. It occurs in two forms. In one, and this is the more common, hæmorrhages constitute a characteristic feature; and in the other, whitish patches. Vascular changes may be present or absent. In certain rare cases a light or orange-yellow color of the fundus may be visible. A typical optic

neuritis is of exceptional occurrence. Other eye lesions have been reported, but they consist of clinical curiosities. They include leukæmic tumors, iritis, exophthalmos from infiltration of the orbital tissues, etc.

Deafness occasionally occurs. Its exact pathology is not known. Tinnitus aurium may be an annoying symptom.

The urine generally contains an abnormal amount of uric acid. According to Salkowski the quantity of this substance excreted is in direct proportion to the degree of splenic enlargement. Albuminuria rarely occurs unless the disease is associated with structural alterations in the kidneys. Hypoxanthin, lactic acid and formic acid have been found in the urine.

Persistent priapism is an early symptom of some cases.

In women, menstruation is arrested.

The Blood Changes. It is on the blood changes that the recognition of leucocythæmia depends. The appearances presented under the microscope vary according as the disease is of the lieno-myelogenic or of the lymphatic variety. In all cases there is both an actual and a relative increase in the number of white blood-cells.

The number of leucocytes may be so increased that they stand in a relation to the red blood cells of one to two or three. In extreme instances red and white corpuscles have been found in equal numbers. The blood itself is of a turbid reddish-brown color. The lymphocytes are greatly reduced in number. Normally they constitute from 20 to 30 per cent. of the white blood-corpuscles; but in spleno-myelogenous leucocythæmia, they may be reduced to as low as one per cent. The cells with polymorphous nuclei and neutrophilic granules are usually diminished. The eosinophiles are either normal or relatively increased in number. In addition to the above there are certain elements discoverable which are not found in normal blood, and were called by Ehrlich myelocytes. They present strong resemblances to the large mononuclear leucocytes. Their protoplasm, however, is filled with fine neutrophilic granules. The red blood-corpuscles are reduced in numbers, but never to the excessive degree characterizing other forms of anæmia. Two million per cubic millimetre has been placed as their minimum number in this disease. Many nucleated red blood-corpuscles are present.

In lymphatic leucocythæmia the increase in the white corpuscles is never as great as in the preceding form, the changes of which have just been described. They are never in greater proportion to the red than one to ten. The lymphocytes are increased, while the other varieties are relatively diminished in number. Myelocytes are absent.

Diagnosis.—The diagnosis of leucocythæmia is made by the microscopic examination of the blood, for there are other diseases in which the gross symptomatology duplicates that of the one under con-

sideration. The extent to which the white blood-cells must increase before the case can be considered one of leucocythæmia has been a cause for discussion. Magnus Huss proposed that only those cases in which the ratio of white to red blood-cells was less than 1 to 20 should be so regarded. Such a diagnostic foundation must be faulty, for each case must at some time present a far greater ratio than this, and yet be a genuine example of leucocythæmia. Moreover, it has been noted that some of the well-developed cases improve to such an extent as not to fall within the limitations proposed by Huss. In all doubtful cases recourse must be had to the color examinations as described in this article and in the section on general considerations pertaining to diseases of the blood.

The conditions for which leucocythæmia may be mistaken are enlarged spleen with secondary anæmia, chronic malarial infection with enlarged spleen, and Hodgkin's disease. Cases of enlarged spleen with anæmia may be differentiated from leucocythæmia at times with the greatest difficulty. This condition may be attended with œdema of the feet, hæmorrhages, dropsy and fever. The only reliable guide for differentiation is found in the blood, which does not contain the large number of white blood-cells of leukæmia.

In chronic malarial infection the spleen is often enormously enlarged, and the external manifestations of anæmia are prominent. There is a history of malaria, the lymphatic glands are not enlarged, and the white blood-cells are not markedly increased.

In Hodgkin's disease the lymphatic enlargement constitutes a prominent feature, and the spleen is but slightly, if at all, enlarged. The white blood-cells may be increased in number, but do not present the characteristic features already described as belonging to leucocythæmia.

Prognosis.—The prognosis of leucocythmæia is very unfavorable. Some few recoveries have been recorded. The ordinary course of the disease is slowly progressive, death ensuing in from a few months to five years. The majority of cases die within two or three years. Exceptionally, a case is observed which runs an acute course, the patient dying in four or five days. Death sometimes results from some of the special symptoms—we might almost call them complications—of the disease. Thus it has been brought about by severe hæmorrhage, cerebral apoplexy, and profuse diarrhœa. In the majority of instances it arises from exhaustion. The course of the disease is decidedly irregular. In many instances there are marked remissions of symptoms, giving the appearance of a return to the normal state of health. Intercurrent affections, which are very liable to ensue, are dangerous.

Treatment.—The treatment of leucocythæmia is decidedly unsatisfactory. With the old school, *arsenic* enjoys the most favor, but those whose experience makes them the most competent to decide are by no

means certain that it accomplishes anything. Quinine has been recommended for the "malarial" cases; but its use seems to be based on theoretical considerations, rather than upon practical results.

So far as we are concerned, we must, for the present, satisfy ourselves with theoretical therapeutics based on symptomatic indications. *Picric acid*, according to the investigations of Erb, is capable of producing an artificial leucocythæmia, but it hardly seems adapted to cases in which splenic and lymphatic enlargements are prominent features. Its symptomatology presents all the general appearances of leucocythæmia. *Thuja* has been recommended for the myelogenic form of the disease, especially in cases in which the patient is very susceptible to exposure to cold and damp. It has the ulcerations of the mouth which so frequently precede, and the swelling of the gums which accompany the disease. There is œdema about the bones and around the joints. *Natrum sulph.* appears to be the best remedy for the cases in which there is enlargement of the spleen and lymphatic glands. *Arsenicum* and *phosphorus* should be indicated in a number of cases.

However unfavorable may be the results of direct treatment of leucocythæmia, much may be done for the alleviation of individual symptoms, and for which a great variety of remedies may be used. Thus *cinchona* is invaluable for the exhaustion following hæmorrhages; *phosphorus* for the persistent bleedings; *nux vomica* and *sulphur* for the gastro-intestinal disturbances; *strychnia* for the prostration, etc.

HODGKIN'S DISEASE.

Synonyms.—Pseudo-leukæmia; lympho-sarcoma; adenie; lymphatic anæmia; general lymphadenoma.

Definition.—Hodgkin's disease is an affection characterized by enlargement of numerous lymphatic glands, associated with anæmia and sometimes with enlargement of the spleen.

History.—A study of the history of Hodgkin's disease meets with considerable difficulty, because of the frequency with which early authors confounded it with tubercular and syphilitic affections of the lymphatic system. Confusion seems to be still further increased by the probability that the cases which we are pleased to denominate examples of Hodgkin's disease appear to be of varied pathological nature. Morgagni and others of his time described an affection of the lymphatic glands accompanied by anæmia. Hodgkin, in 1832, in a paper entitled "On Some Morbid Affections of the Absorbent Glands and Spleen," brought this class of cases formally before the profession; but he erred, as did his predecessors, in including also what are now regarded as undoubted examples of tubercular adenitis. The various names given the affection exhibit the confused ideas held regarding its pathology. It was named lympho-sarcoma in 1845 by Virchow; pseudo-leukæmia by Cohnheim;

malignant lymphomata by Billroth; adenie by Trousseau; and Hodgkin's disease by Wilks in 1865. For the present, the latter is probably the preferable designation.

Etiology.—The etiology of Hodgkin's disease is fully as obscure as is that of the other varieties of disease of the blood-forming apparatus. It shows a greater tendency to attack young subjects than does leucocythæmia. Nearly two-thirds of the cases occur in persons of less than forty years of age. In Gowers' series of 100 cases, 30 were under twenty, and 34 between twenty and forty years of age. Heredity has been shown to be entirely without etiological importance. Male subjects are far more predisposed than females, fully three-fourths of the cases occurring in the former. The claim that syphilis and tuberculosis are capable of producing Hodgkin's disease is not warranted by clinical studies. Each of these affections is capable of producing glandular affections which are *sui generis*, and in no way agree with the clinical totality of the disease under study. The efforts made to trace it to a malarial origin have also proven futile. It is possible that influences which undermine the general health, as intemperance, starvation, poor ventilation and bad hygiene generally, may serve as predisposing factors.

Theoretical considerations have been advanced to prove that pseudo-leukæmia is due to infectious processes, although experimental and clinical evidence of such a theory is still lacking. Tissier believes that infection takes place by the skin, the tonsils, or the intestines. Westphal claims that the primary infection is through an ulcerative disease of the mouth, as is said to be the case in leucocythæmia. Dreschfeld believes in the infectious nature of pseudo-leukæmia, but is unwilling to state its nature or its avenue of entrance into the body. Klebs points out the similarity of the pathological changes to those of infectious granulomata. The metastatic tendency of the glandular affection is adduced by Cohnheim and Virchow to prove an infectious rather than a neoplastic process.

The efforts made to show that Hodgkin's disease is a modified glandular tuberculosis have not been crowned with success. Brentano and Tangl discovered the tubercle bacilli in one alleged case; but decided finally that it was an example of tuberculosis pure and simple. Weinhaupt failed to find tubercle bacilli in even one of twelve cases of undoubted Hodgkin's disease. Roux and Lannois claim to have shown that the disease may arise by infection with the staphylococcus pyogenes aureus.

The importance of local irritation giving rise to glandular affections affording a suitable starting point for Hodgkin's disease has not been decided. It is worthy, however, of serious consideration.

Pathology and Morbid Anatomy.—The morbid changes of Hodgkin's disease are found in the lymphatic glands and in the lymphatic tissues wherever existing. The glands themselves are enlarged. Those

first involved are usually the ones superficially placed in the neck. Next in order of frequency are the glands of the axilla. In a general way it may be said, and that fact was pointed out by Hodgkin, that those glands which follow the large arteries, *e. g.*, the glands of the neck, axilla and inguinal region and those of the thorax and retroperitoneum, are the first to be affected.

The characteristics of the glandular enlargement vary in different cases. Thus they may be hard or soft, usually, however, the latter. This fact led Virchow to divide the disease into hard and soft varieties, a division which is impracticable for clinical purposes, because many cases exhibit both types of glandular hypertrophy. The cut surface of the glands is smooth, and a thin transparent fluid exudes, varying in quantity according to the case. In some the section is comparatively dry. The glandular septa are sometimes greatly thickened; at other times they are normal; or they may vary greatly in thickness in different parts of the same gland. The color of the section is yellowish or yellowish-gray. According to Gowers and Taylor, the glands are firmer in the initial stages of the disease, and become softer as the case proceeds. This statement does not seem to be in accord with the observations of others. Sometimes extravasations of blood into the glandular substance are discovered. As a rule the affected glands are perfectly movable. Herein they differ from scrofulous enlargements in which the glandular masses are apt to be matted together.

Microscopically, the changes are found to consist of increase in the cells and thickening of the reticulum.

Secondary changes may take place and consist of caseation, suppuration, fatty degeneration, or calcification. It is the occurrence of the first of these changes which has led to the suggestion that these cases are possibly of tubercular origin. Suppuration only takes place in the presence of pyogenic infection, and does not belong to Hodgkin's disease *per se*. It is especially apt to occur in the superficial structures.

The spleen is involved in about 80 per cent. of the cases. This organ is more or less enlarged, owing to hypertrophy of the Malpighian follicles. The splenic tumor is never, however, as great as in leucocythæmia. Disseminated growths of irregular size are observed throughout the substance of the organ, and are yellowish or grayish-white in color. Their consistence is usually about the same as that of the affected lymphatic glands. They vary in size from a pin's head to one or two centimetres in diameter. The splenic pulp may be normal, diminished from compression by these follicular enlargements, or increased. Sometimes the latter change is the only one present, in which case the enlargement of the spleen is uniform, and may proceed to a greater extent than when the involvement of the Malpighian follicles constitutes the prominent feature. The cut surface of the spleen is

very apt to present a variegated appearance owing to the whitish or yellowish follicles scattered throughout the reddish-brown splenic pulp.

In certain rare cases the bone-marrow has been found to present changes bearing a very close resemblance to those found in leucocythæmia.

New formations of lymphatic tissue may be found in any organ or tissue of the body, the parts most likely to present this change being the liver, kidneys, lungs, heart, testicles and digestive tract. The adenoid tissue takes its origin from the connective tissue of the affected organ. Occurring in the lungs, they are very liable to be mistaken for tubercle. Sometimes the follicles at the base of the tongue, the tonsils and the adenoid tissue at the vault of the pharynx are greatly enlarged and become important clinical phenomena during life. The involvement of the intestinal follicles sometimes leads to enormous thickening of the walls of that tube, but never, so far as known, to the degree of intestinal obstruction. In some few cases nodular deposits in the skin have been observed. In two cases reported, a lymphatic enlargement within the spinal canal led to complete paraplegia.

Symptomatology.—The first evidence of the onset of Hodgkin's disease is found, in the majority of cases, in the enlargement of lymphatic glands in one or another portion of the body, usually those of the neck, and of these the cervical group is first attacked. Exceptionally, the submaxillary glands are first involved. Sometimes it is the glands of the axilla or of other portions of the body which first show the ravages of the disease. Very often the glands upon but one side are first involved, the disease giving no manifestations of extension for a prolonged period, sometimes not for several years. The direction in which the disease spreads seems to be a subject for differences of opinion. Some say, and these are in the minority, that it extends in the course of the lymphatic channels; others, that the enlarged glands are those accompanying important arteries, and that there is no regular succession of involvement. Certain it is that in some cases the glandular enlargement on one side of the neck may be followed by the same condition in the opposite axilla or in the groin.

During the initial stages of Hodgkin's disease the affected glands are perfectly movable, and are not at all tender to touch. As they increase in size and number, they form bunches. In some instances in which the involved glands are superficially situated, ulceration takes place. When the disease involves the deeper glands, the clinical phenomena are both varied and interesting, depending upon the situation of the enlarged structures and the tissues which they compress. It may even happen that these glands are the first involved, in which case the true nature of the pathological process is obscured until the anæmia and the superficial enlargements are manifested. When the thoracic glands

are enlarged there may be dyspnœa and thoracic pain. Osler records one remarkable instance in which pressure exerted by these structures completely obliterated the superior vena cava. The patient suffered considerably from cephalic congestion. A fairly good collateral circulation had been established through the superficial veins of the chest walls which were converted into a "huge felt-like mass of dilated veins, the latter emptying into two large trunks, the dilated epigastric veins." In the case of extreme axillary enlargement there may be brachial neuralgia and œdema of the corresponding arm and hand. When the disease in this situation is at all extensive, the glandular enlargements may be found as far forward as beneath the pectoralis major and minor muscles, and as far backward as beneath the scapula. Cough, dyspnœa, and difficult deglutition may be produced by extreme enlargement of the cervical glands. Disease here may also so compress the great bloodvessels of the neck as to interfere sadly with the cerebral circulation. Great enlargement of the inguinal glands is rare, but it may occasionally give rise to neuralgia and œdema of one or both lower extremities. The retroperitoneal glands extending from the diaphragm, the pelvis, and surrounding the aorta, vena cava and nerves may be extensively diseased and cause, by the compression they exert on neighboring structures, obscure neuralgia and circulatory disturbances. When the subject is thin, the glandular enlargements can readily be made out by palpation; in very stout persons their recognition is nearly, if not quite, impossible. Sometimes the enlarged retroperitoneal glands may be so matted together as to give the idea of the existence of some intra-abdominal growth, for the removal of which an operation may be attempted. The rate of growth of the affected glands varies greatly in individual instances. In some they remain stationary for years; in others, the disease progresses rapidly, so that the case is well advanced within a few months of the time of onset. They may also vary from time to time; one day they are enlarged; in a month or so they may have returned to the normal size, only to relapse at the first favorable opportunity. The glandular enlargements may greatly diminish shortly before death.

The spleen is generally enlarged, its condition being readily recognizable by physical examination. As already stated, it never attains the size observed in leucocythæmia. It can but rarely be felt below the ribs.

Anæmia is an important feature of Hodgkin's disease. It may even be that it is the first symptom to obtrude itself on the patient. The microscopic and chemical characters of the blood are very different from those of leucocythæmia. The red blood-corpuscles are reduced in number, rarely, however, to less than 2,000,000 per cubic millimetre. There is no poikilocytosis, at least to any great extent. As a rule there is no marked increase in the number of white blood-cells. In some

cases the proportionate number of lymphocytes is considerably increased, in which case the possibility of a lymphatic leucocythæmia must be entertained.

The ordinary phenomena attendant upon anæmias in general are present. The patient tires readily on exertion and palpitation of the heart exists to a greater or less degree. Functional cardiac murmurs may be heard. Dyspnœa may be due to the altered state of the blood, or to the pressure of the enlarged glands on important structures as already stated. The anæmia may ultimately give rise to a fatty condition of the heart muscle, in which cases the phenomena attendant upon weakened cardiac action become prominent. In some cases the heart's action is disturbed by the pressure of the cervical glands on the pneumogastric.

Fever seems to be a pretty constant phenomenon. It is especially marked in the later stages of the disease and is not of a fixed type. In some cases it pursues a decidedly hectic course, with marked morning remissions; or it may be practically continuous with slight evening exacerbations. Sometimes it possesses an ague-type, but the paroxysms come at irregular intervals. The latter class of cases are of considerable interest. For weeks or months the paroxysms recur and then disappear but only to return. The maximum temperature may reach 103° or 104° F.

Symptoms referred to the digestive tract are often present, though not prominent. Stomatitis sometimes attends. In some cases there are evidences of impaired digestion, *e. g.*, discomfort after eating, nausea, and vomiting. The formation of adenoid tissue in the intestinal tract may lead to diarrhœa. In some cases constipation is the prevailing condition. The tonsils are occasionally so much enlarged as to interfere greatly with deglutition, and even demand the use of the tube for feeding purposes.

The liver may be enlarged owing to the presence of lymphatic growths within its substance. Jaundice is not present unless the glands exert pressure upon the bile-ducts. Ascites is sometimes present and is due to obstructed portal circulation by the enlarged glands.

In some cases there is a bronzing of the skin which has been attributed to pressure of the enlarged glands upon the suprarenal capsules.

The urine is generally normal. Albuminuria, however, may be present.

In women menstruation is irregular or suppressed. In men there may be lymphatic growths in the testicles.

Deafness sometimes appears owing to occlusion of the eustachian tubes by the pressure of adenoid growths in the pharynx. There may be inequality of the pupils arising from pressure of the enlarged cervical glands upon the sympathetic.

In some cases in which the anæmia is profound, there may be subcutaneous œdema. Pruritus has proven a troublesome symptom of some cases.

Diagnosis.—Hodgkin's disease is liable to be mistaken for leucocythæmia, ordinary scrofulous enlargement of the lymphatic glands, and malignant disease. From leucocythæmia it is to be recognized only by an examination of the blood. In that affection the splenic hypertrophy is an early phenomenon, as a rule; the glandular enlargement appearing late. In scrofulous enlargement of the lymphatics, the glandular enlargement is limited and the affected glands are those subject to local irritation, *e. g.*, the submaxillary and the cervical. This condition also is liable to appear in children. The tumors are liable to suppurate. They are not as freely movable on each other as in Hodgkin's disease, when the latter appear in bunches. In malignant disease there is nearly always some evidence to show that primary growths have involved one or the other of the viscera or tissues, and that the glandular disorder is secondary. The enlarged masses are also adherent to each other. Syphilis is an occasional source of error. It is to be recognized by the clinical history and the presence of conditions characteristic of syphilitic infection.

Prognosis.—Hodgkin's disease offers a very unfavorable prognosis, nearly all cases proceeding slowly to a fatal termination. The course of the disease is, however, very irregular, being characterized by periods of exacerbations and remissions. Those examples of the disease in which but few glands are enlarged, and in which the tendency to extension to other glands is but slight, present a much better outlook than do others, although even these ultimately result fatally. Long-continued high temperature may be regarded as an unfavorable indication.

The location of the glandular tumors constitutes an important factor in framing a prognosis, for when they are so situated that they compress important structures, disturb the action of the circulatory and respiratory apparatus, or interfere with nutrition by pressure upon the portal vein or gall-duct, the unfortunate result follows more rapidly than would otherwise be the case.

Death usually results from exhaustion. The average duration of the disease is two years. The previous state of health of the patient, however, exerts an import influence, as cases occurring in delicate subjects succumb much sooner than do others. Exceptionally, cases run a very rapid course. This is said to apply particularly to those appearing after lying-in.

DISEASES OF THE DUCTLESS GLANDS.

The ductless glands include the suprarenal capsules, the thyroid and the thymus glands.

Considering these *seriatim*, the disease of the suprarenal capsule which has claimed the most attention is

ADDISON'S DISEASE.

Synonyms.—Bronzed skin disease; melasma suprarenale; morbus Addisonii.

Definition.—Even at the present day no better definition of Addison's disease can be given than that formulated by Addison himself as follows: "The leading and characteristic features of the morbid state to which I would direct attention are anæmia, general languor and debility, remarkable feebleness of the heart's action, irritability of the stomach and a peculiar change in the color of the skin occurring in connection with a diseased condition of the suprarenal capsules."

Etiology.—The majority of cases of Addison's disease occur in male subjects. Greenhow's statistics, which have been most extensively quoted, give 119 to 64 as the relative proportion in the matter of sexual predisposition. The disease may occur at any time of life. Some authorities limit the possibilities of occurrence to any age between five and fifty years; but Belaieff has reported one in which the ailment was congenital, the patient dying at the age of eight weeks. The majority of cases occur between the ages of thirty and fifty years. Traumatism is alleged to have been the exciting cause in some instances, the injuries having been sustained by the vertebræ or abdomen. A very large proportion of the victims give a history of years of arduous manual labor. In some of these the disease is attributed directly to some strain of the muscles of the back, with what justice cannot be positively stated.

Pathology and Morbid Anatomy.—The morbid anatomy of the lesions of Addison's disease is a subject concerning which very different opinions are held. The fact that the suprarenal capsules are involved in nearly every instance is not disputed; but concerning the nature of the lesions and their relation to changes found in other structures authorities differ. It is now certain that the essential character of the changes in the glands is tuberculous. Still there is no doubt that occasionally non-tuberculous lesions of the suprarenal capsules are accom-

panied by the classical symptoms of Addison's disease. In favor of the tubercular nature of the disease are the following facts: (1) Addison's disease is frequently complicated with tuberculous changes in other organs, *e. g.*, the lungs. (2) Tubercle bacilli are frequently found in the caseous nodules occupying the diseased glands. (3) The changes themselves are generally such as we would assign to a tubercular origin. Grayish-white nodules form in the medullary portion of the capsules, and these are surrounded by groups of structures resembling miliary tubercles. These new growths consist of lymphoid cells lying in a delicate fibrillary stroma. Caseous degeneration finally sets in in these masses, and purulent metamorphosis may ultimately take place. Still later, absorption of these masses may take place, leaving contracted cicatrices. It is claimed that while these lesions are often primary, they are far more frequently secondary to tubercular changes in other portions of the body.

We find, however, that the study of this interesting disease develops the existence of many facts which cannot be reconciled with each other in the present state of our knowledge respecting the physiology of the suprarenal capsules and the clinical manifestations of its diseases. Thus extensive changes in these bodies have been observed in a number of instances in which none of the symptoms of Addison's disease existed during life. Additional contradictions relating to the pathology have been added by the further discovery that the adrenals may be perfectly healthy in the presence of the characteristic symptoms of Addison's disease. Pathological research has demonstrated that in many instances the important nerve plexuses of the abdomen, *i. e.*, the branches of the solar plexus, are diseased. Generally these are found imbedded in extensive formations of connective tissue, while they themselves are thickened, and the seat of connective tissue changes. Some observers have gone to the length of regarding this connective tissue fibrosis as the essential lesion of the affection in question, especially as very serious malignant disease and even destruction of the adrenals often fail to produce the phenomena of Addison's disease. The frequency of these nerve changes has been shown by Thompson's investigations, they being present in sixty out of eighty-seven cases.

Reiche's case of cancer of the trachea with secondary deposits in the adrenals shows, however, that bronzing of the skin,—the most prominent symptom of Addison's disease,—does not necessarily depend upon degeneration or disease of the sympathetic nervous system.

The view that Addison's disease is due to disturbed function of the suprarenal capsules has been promulgated. It is said that the latter structures secrete a substance, which absorbed into the system destroys certain toxic products constantly present in the body. Auld, for example, suggests that one of the functions of the suprarenal capsules is to destroy

a part of the used-up red blood-corpuscles. If this function is disturbed, the products of hæmoglobin destruction remain unneutralized, and intoxication ensues. Abelous and Lalglois have shown by their experiments on animals that if the entire capsules are removed, the animals operated upon die of poisoning, while if a portion of the gland is permitted to remain, no disturbance results.

In some cases marked atrophy of the adrenals has been noted. In many such instances, the associated nerve plexuses have also been found atrophied. Copeland regards the latter as the primary condition, the former a result of the same. It has been suggested that this atrophy is the final stage of the lesions first described; but this is unlikely if we are to judge of the ultimate results of tuberculous processes in general.

The Zucos believe Addison's disease to be neurine intoxication, basing their opinions on the discovery that the suprarenal bodies contain a large quantity of that substance.

Symptomatology.—Addison's disease is of slow onset. The first manifestation of ill-health varies in different cases. In many the discoloration of the skin is the first symptom to make its appearance; in others, this does not take place until the affection is far advanced and the patient about ready to die. The other symptoms are those attendant upon a progressive asthenia.

The tint of the discolored skin ranges from a light yellow to what may almost be called black; it is usually described as a "bronzing." It is apt to be particularly prominent on uncovered parts of the body and on those regions in which pigment is especially apt to be deposited under normal conditions, *e. g.*, about the nipples, the genitals, and parts exposed to friction or pressure. When the discoloration is in patches, the margins shade off gradually to the normal skin; there is no well-defined line of demarcation. This is an important point to remember as it serves to differentiate Addison's disease from certain varieties of melasma. The mucous membranes may also be involved, pigmentary patches being discernible on the mucous membrane of the mouth, tongue, and vagina. It has been said that the conjunctiva escapes, but this assertion is too sweeping to be correct. Whether or not internal organs are ever the seat of pigmentary deposit is not known. Carrington claims to have noticed such a condition in the pia mater of the brain in one case. In very many cases the hair undergoes a gradual deepening of its color.

Gastric symptoms are prominent in Addison's disease. The appetite is capricious; nausea and vomiting appear early and occur without apparent cause. Diarrhœa may set in, especially during the closing stages of the disease.

Asthenia is an early and profound symptom, the slightest mental or physical effort occasioning great fatigue. The hands and feet are cold

and clammy. In some cases it may be necessary for the patient to keep to his bed despite his good condition to all outward appearances. Under such circumstances attacks of syncope may occur on rising from the recumbent posture. These syncopal attacks are sometimes observed in patients going about and in a number of instances have been the cause of sudden death. As the case progresses the facial expression indicates the extreme weakness; the voice becomes feeble; mental processes are sluggish; finally delirium sets in and death ends the scene.

The heart's action is weak; and yet there is very little dilatation of that organ. The pulse is small and of low tension.

Anæmia was made an important part of the clinical picture of this disease by Addison. Observations recorded since his time, however, show the incorrectness of his conclusions in this respect. The red blood-corpuscles are rarely decreased in number and may even be increased. There is no increase in the number of white blood-cells. Free pigment granules have been found in the blood.

Emaciation is unusual. On the contrary the bulk of both muscles and fat is singularly well preserved.

Much interest has been taken in the condition of the urine. The total daily quantity passed varies but little from the normal; sometimes it is diminished, and sometimes increased. Albumin is usually absent. The quantity of indican is generally increased. A deficient elimination of uric acid has been observed.

Complications.—Addison's disease is especially liable to be complicated by tuberculosis of different organs, especially of the lungs and vertebræ. Spinal caries not infrequently precedes the disease, and may find its origin in traumatism of the back.

In some cases mammillation of the stomach due to growth of lymphoid tissue between the gastric tubules has been observed. These may undergo ulcerative changes.

The spleen is sometimes enlarged.

Diagnosis.—The liability to error in the recognition of Addison's disease arises from the diversified pathological conditions which may be associated with pigmentary changes in the skin, and the not infrequent occurrence of this disease with pigmentation late or even absent. Under the latter circumstances one can make a diagnosis of Addison's disease by exclusion only, *i. e.*, by excluding all other diseases which may produce asthenia, such as abdominal cancer, pernicious anæmia, etc.

Pigmentary deposits occur in quite a variety of pathological conditions within the abdomen, *e. g.*, tubercular peritonitis, uterine disease, chronic dysentery, malarial poisoning, cirrhosis of the liver and cancer of the stomach. Pigmentation is very common in pregnant women, especially about the nipples, in the linea alba and the forehead, but it disappears after labor. Its occurrence is well-known even to the laity.

Pigmentary deposits have been observed very frequently after syphilitic eruptions. The history of the cases is sufficient for a diagnosis.

Greenhow has directed attention to the discoloration of the skin which occurs in vagabonds under the combined influences of the sun, and long-continued irritation from vermin and dirt. Such cases should not be confounded with Addison's disease. The possibility of error need only be mentioned to be avoided.

Long-continued use of arsenic frequently produces pigmentary deposits in the skin.

Prognosis.—Addison's disease is said to be invariably fatal. Neumann reports the recovery of a patient in whom he had diagnosed this affection. The symptomatology as given by him seems to have been complete. The average duration of cases is about one year. Still the disease may run a very rapid course, or it may be prolonged over a number of years. The course of the disease may be interrupted by marked remissions of symptoms. Death is produced by asthenia; occasionally the patient dies suddenly from syncope or in coma and convulsions.

Treatment.—Very little can be expected from curative treatment, because of the inevitably fatal character of the disease. The patient's strength should be as much as possible preserved by rest, and the danger of syncope thereby avoided. Stimulants may prove necessary when the asthenia is profound. The digestive disturbances require that the patient should be given easily digested food; at the same time care must be taken that it is as highly nourishing as possible.

Extract of the suprarenal capsules has lately been recommended as a possible curative measure. The results thus far reported are not sufficient to give us much encouragement.

Among medicines, *arsenicum, nitrate of silver, calcarea ars., iodine* and *theridion* have been most highly recommended. *Arsenicum* is suggested by Hughes as theoretically of value. Practically he obtained but little result from its exhibition. Arsenic produces the pigmentation of the skin, the gastro-intestinal irritability and the other symptoms which may accompany Addison's disease. *Argentum nitricum*, in the experience of physicians connected with the Metropolitan Hospital (homœopathic), New York, serves to lessen suffering and prolong life. The cutaneous discoloration of the skin produced by it is of no therapeutic value, because it is a chemical and not a dynamic effect of the drug. Nitrate of silver is made especially valuable in Addison's disease because of its influence over degenerative nerve processes in general; and these are certainly present in this disease. It also produces loss of appetite, chronic wasting, lowering of the bodily temperature and diarrhœa.

GOITRE.

Synonyms.—Bronchocele; Derbyshire neck; struma.

Definition.—Goitre is an enlargement of the thyroid gland not dependent upon inflammation or malignant new formations.

Varieties.—Parenchymatous; cystic; fibrous. Special varieties arising from changes taking place in the growth have been designated calcareous, colloid, and amyloid.

Etiology.—Although much has been observed respecting the circumstances surrounding the appearance of goitre, the etiology of the disease is in an unsettled condition. Women are far more frequently its victims than men, their predisposition as compared with the other sex being variously stated by authors as 2:1 to 44:1. Their preponderance of liability is observed even in youth.

Goitre is especially liable to appear in certain localities, in some of which, as parts of the Punjaub in India, fully 60 per cent. of the population is affected. It is also very common among certain valleys of the Alps, in which the sunshine enters but a few hours daily, in the Pyrenees, in the South American Andes, and in Derbyshire, England. In all of these localities goitre is said to be endemic. A study of the conditions under which the inhabitants of these places live has given rise to many surmises but no positive information. The natives in each of these regions live under decidedly unhygienic conditions.

The fact that the drinking water is very often strongly impregnated with lime salts has been assigned as a cause; on the other hand, goitre is uncommon in Norway, Sweden, and Scotland, although limestone formations are very common in these countries. Thursfield believed that goitre is produced by the presence of iron pyrites in the water-bearing strata of the earth. In former years the disease was attributed by many to the drinking of snow water; but against this theory it is urged that goitre is rare in Greenland and Iceland, and is observed in countries in which snow is never seen.

The carrying of heavy loads has been assigned as a cause. Especially has this been urged as an important factor in the production of epidemics among soldiers exposed to the hardships of insufficient food and rapid forced marches. It is claimed that where the practice of carrying heavy loads on the heads has been abandoned, the occurrence of goitres in endemic forms has largely decreased.

Endemic goitre appears to be of rare occurrence in America, at least during recent years. At one time the disease was quite prevalent in certain portions of New York State and Canada, and in the Green and White Mountains.

Goitre occasionally occurs in epidemic forms. It then usually asserts itself among troups garrisoned in goitrous districts; in one of these epi-

demics, it is reported that fully 30 per cent. of the regiment was affected. In all cases, the goitre disappeared but slowly on return of the patients to their homes. This occasional occurrence of the disease in epidemic form has given rise to the suggestion that possibly some infection is at the origin of the trouble; but this hypothesis has but few data to recommend it for serious thought.

Pathology and Morbid Anatomy.—According to their anatomical features goitres have been divided into parenchymatous, cystic, fibrous, calcareous, colloid, and amyloid.

Parenchymatous goitres are also spoken of as follicular. In this variety the follicles of the thyroid gland are enlarged. This is accompanied by a more or less marked increase in the connective tissue, which element increases with the age of the goitre. This variety in its early stages is soft or compressible, and to palpation gives a fairly well-defined sense of fluctuation. With increase of the connective tissue formation, it becomes firmer and harder.

The fibrous goitre is generally but a modification of the preceding variety, arising by reason of the great increase in connective tissue, which contracting on the follicular structures obliterates them. The fibrous change is unevenly distributed throughout the glandular substance as a rule, hence the tumor gives a hard knotty feel to the sense of touch.

Cystic goitre is also believed to be a transformation of primary follicular disease, the follicles of the gland being distended with colloid material. The pressure thus occasioned brings about the disappearance of the interlobular connective tissue; surrounding follicles are likewise obliterated and large cystic cavities are formed.

Symptomatology.—The main symptoms of goitre are objective only in the majority of instances, and are appreciable on simple inspection of the neck. A swelling is observed over the region of the thyroid gland, ranging in size from a simple fulness to a large pendulous growth, which, in extreme instances, may require the mechanical support of a special suspensory. One or both lobes may be enlarged with or without the isthmus of the gland; it is very rare for the latter to be alone affected. The integument over the tumor is unchanged in appearance and is freely movable. During deglutition the goitre is observed to make a vertical movement. Sometimes there is a slight sensation of fulness or discomfort.

When the goitre is very large, especially when special portions of the thyroid gland are involved, pressure upon important structures gives rise to a number of annoying or serious symptoms. Thus, pressure upon the trachea causes stenosis of that tube, and dyspnœa, which is greatly aggravated on the occurrence of a slight cold. The voice may be impaired from pressure upon the thyroid cartilage; aphonia may even de-

velop, and is attributed to pressure upon the recurrent laryngeal nerves. It is said that the pneumogastric nerves and the brachial plexuses may be injured by large growths, but such instances must be rare. It is far more common to observe impairment of the cephalic circulation by pressure upon the arteries and veins of the neck. When the former are affected, tetany and convulsions have appeared, and when the latter, headache and drowsiness, associated with a dusky hue of the face.

Dysphagia sometimes occurs, though but rarely. It is due to compression of the œsophagus. It has been suggested that this symptom is more likely to result in inflammation of the œsophagus rather than from direct compression of that tube.

Goitres are often observed to vary in size from time to time. Thus they not infrequently enlarge during the menstrual periods or during pregnancy.

Constitutional symptoms are sometimes present. Thus hæmophilia has been observed. In certain districts cretinism is associated with the disease. Sometimes the general nutrition of the patient is considerably disturbed, but in the majority of instances the patient, aside from the local condition, is in possession of exceptionally good health.

Diagnosis.—The recognition of goitre is usually a simple matter, the fact that the growth is of the thyroid gland being conclusively shown when it makes vertical movements during the act of swallowing. Malignant disease, which may be confounded with goitrous enlargement, is associated with pain, the overlying cutis is involved and adherent, and the morbid changes are general. Constitutional symptoms appear early; as do also local pressure symptoms. The neighboring lymphatics exhibit signs of infection. Malignant disease is of rapid growth. It must be borne in mind that carcinoma or sarcoma may invade a thyroid gland already the seat of goitre.

The greatest diagnostic difficulties are encountered in those rare instances in which the enlargement involves aberrant portions of the thyroid gland, which may be found anywhere between the hyoid bone and the arch of the aorta. Enlargement of these structures may give rise to obscure intrathoracic tumors.

Prognosis.—The prognosis of goitre, as to danger to life, is generally favorable. It is in exceptional instances only that the disease resists treatment and increases to such an extent as to threaten life. In some cases the condition disappears spontaneously.

Treatment.—If the patient is a resident of a goitrous district it is important to remove to a more healthful locality, and to see that good nourishing food and a supply of pure drinking water be furnished. Cases developing during a residence in the mountains should be removed to the seashore. Fresh air and sunlight are important. As to remedies, both schools of medicine look upon *iodine* as the most important. It is

not by any means a specific. By the old school it is used locally in the form of the tincture, which is painted over the gland every few days, together with the administration of *iodide of potassium* in doses of three grains three times daily. Given in dilutions it is efficacious in many instances, especially when the growth is of recent date and still soft. *Spongia* is another valuable remedy. It also was used by the old school in the form of burnt sponge, until it was discovered that its influence was due in a measure to the contained iodine. This remedy was employed by Jousset in alternation with iodine. The special indications governing their selection relate more to constitutional peculiarities than to local objective states. *Calcarea carb.* likewise is a popular remedy, it too being suggested by the peculiar build or constitution of the patient. *Baryta iod.* is best adapted to cases associated with a cretinoid state. *Phytolacca* has benefited nodulated goitres, associated with jerking, shooting, lancinating pains, and aggravated during damp weather. *Bromine* is indicated in cases occurring in fair, light-haired individuals. I have seen goitre disappear under the use of syrup of *hydriodic acid* in teaspoonful doses three or four times daily.

These measures failing, resort may be had to quite a variety of local measures. The majority of these are designed to produce local destruction of the hypertrophied tissue. Various substances have been injected into the gland, tincture of iodine being the most popular. From fifteen minims to one drachm should be injected twice a week, care being taken not to puncture a vein or the trachea in this little operation. The injection is usually followed by slight inflammatory tumefaction, which in turn is succeeded by gradual reduction in the size of the tumor. The iodine must be injected into the substance of the gland since otherwise it will produce abscesses. Electrolysis is efficient within certain limits. The first séance is usually followed by a marked reduction in the size of the tumor. Each succeeding application is observed to have less and less influence. Still, in some cases, this form of treatment is very satisfactory. Large needles insulated to within a short distance of the points should be introduced into the glandular substance and then attached to the negative pole; the positive pole should be attached to a large flat electrode, which may be applied over the thyroid gland at a short distance from the needles. The needles should be kept *in situ* and a current of five to ten milliamperes continued for five minutes.

In intractable cases which threaten life, surgical operation for removal of the goitre should be resorted to. Such cases are, however, very rare. Indeed they include as a rule cases whose early care and treatment have been sadly neglected. Objection to the knife in the cure of goitre has been made because of the fatality of the operation, and the cretinoid condition observed to follow the removal of the entire gland in animals and the human subject. The former objection is now much less

forcible than formerly, modern surgical technique having reduced the mortality to nearly 6 per cent. in the hands of good operators. The thyroid cachexia may be easily avoided by permitting a portion of the gland to remain.

MYXŒDEMA.

Synonym.—Cachexie pachydermique.

Definition.—Myxœdema is a disease characterized clinically by a mucoid deposit in the subcutaneous and submucous connective tissue, a sluggish mental condition, diminished bodily temperature, disturbed nutrition, and believed to be dependent upon impairment of the function of the thyroid gland.

History.—This disease was first described by Sir Wm. Gull in 1875 as a cretinoid state. The name "myxœdema" was given it by Ord four years later. The latter authority even at that time traced a connection between it and atrophy of the thyroid gland. Notwithstanding this the opinion that the disease depended primarily on changes in the sympathetic nervous system was very popular, Allen McLane Hamilton as recently as 1887 giving very strong adherence to this view. Kocher and other surgeons had observed a peculiar cachectic condition in patients from whom the entire thyroid gland had been removed, and this they called "cachexia strumipriva."

Etiology.—The majority of cases occur in women. Of Hamilton's six cases, but one was a man. In France this sexual predisposition to the disease does not seem to be so well marked as elsewhere. In some few cases heredity is an important causal factor. The actual cause of myxœdema is loss of function of the thyroid gland; but the agencies which bring about this latter condition are still unknown. Attempts have been made to trace a relation to diseases of the female sexual organs. Neudorfer believes that during the period of sexual activity, chiefly, the thyroid gland has a direct trophic and regulating influence on the nourishment and development of the generative organs. He asserts that it is only during this period that extirpation of the gland will have any influence in causing disturbances of nutrition. Zanda suggests the spleen as having something to do with the production of myxœdema, for he has observed that when that organ has been removed from dogs, a subsequent thyroidectomy does not produce the cachexia strumipriva. In one instance a myxœdematous condition arose from syphilitic disease of the thyroid gland.

Symptomatology.—The general symptoms attendant upon the early stages of myxœdema are of a decidedly vague character and do not receive their correct explanation until the characteristic physiognomy of the disease asserts itself. These early symptoms include coolness of the extremities and surface of the body, poor appetite, palpitation of the

heart, fatigue on slight exertion, and sluggishness of mental processes. The characteristic condition of the face referred to is produced by the mucoid infiltration of the subcutaneous tissues. The face is swollen in every part, and pale and waxy in color. The eyelids are greatly swollen, the alæ of the nose are broadened, and the usual wrinkles are obliterated. This swelling does not pit on pressure, nor does it shift from one part of the face to another under the influence of gravity. The tongue may be involved, the swelling of this organ at times attaining such a degree as to make articulation difficult if not impossible.

Other portions of the body are also involved in this mucoid œdema. The larynx is sometimes affected, the voice being greatly altered. The swelling of the hands changes their shape in such a way as to have led Sir Wm. Gull to describe them as "spade-like." Especial attention has been directed to a tumefaction in the lower triangle of the neck above the clavicle. Eventually the entire body may be invaded.

The skin itself becomes dry and harsh. The nutrition of the hairs suffers; accordingly they fall out or break off. The altered condition of the submucous tissues of the mouth and gums leads to impaired nutrition of the teeth, which loosen and may even fall out.

Next to the mucous infiltration, the nervous symptoms of the disease are the most prominent. Clouston, as the result of studying nine cases, has described the mental symptoms as "first slowness of mental action, emotional depression, irritability, morbid suspicions, non-restiveness to outward causes of disturbance, general loss of control, enfeeblement with some exaltation in some cases; lastly, lassitude, hebetude, and just before death, mental negation." In addition to the mechanical effect of the infiltration upon the speech, that function is impaired by reason of the mental condition becoming slow and measured. The general conduct of the patient is in keeping with the mental state, the movements being decidedly sluggish. Strength is deficient, consequently the patient falls readily. Ord sums up the motor symptoms as a toneless condition of the muscles with torpor of the muscular sense.

Of the special senses, those of taste and smell are the most frequently impaired, the patient sometimes complaining of most unpleasant perceptions referred to these functions.

The bodily temperature is nearly always subnormal, ranging as a rule from 94° to 98° F. Subjectively the patient complains of cold sensations, which may necessitate the use of thicker clothing than ordinarily required for the prevailing weather.

The urine is increased in quantity and free from albumin. Under the influence of the internal administration of the thyroid juice as a curative remedy for myxœdema, marked diuresis occurs with increased nitrogenous elimination. In the final stages of the disease, albuminuria is said to occur, probably because at this period there are organic changes in the kidneys.

A hæmorrhagic tendency is sometimes well marked, which led Kirk to call attention to myxœdema as a possible cause of some cases of uterine hæmorrhage of unknown origin. Small wounds, as those from the extraction of teeth, may be followed by most troublesome bleeding.

When the disease occurs in children there is a marked arrest of mental and bodily development.

Diagnosis.—There should be no difficulty attending the diagnosis of myxœdema; the subcutaneous mucoid œdema, the absence of pitting on pressure and albuminuria, the failure of the swelling to shift from one part of the body to another under the influence of gravity, and the sluggish mental and physical state, are sufficiently characteristic to prevent its simulation by any other disease.

Prognosis.—The prognosis of myxœdema was, until within a very short period, regarded as exceedingly unfavorable, the tendency being to slow progression to a fatal issue. The duration of the disease is variable. Cases are under observation in which the trouble has existed for fifteen years. Death not infrequently results from some intercurrent disorder.

Treatment.—The first element in the treatment of myxœdema is the enforcement of hygienic details suggested by the symptoms of the disease. The coldness of the surface of the body is a strong indication for the maintenance of bodily warmth by woolen clothing and keeping the patient's apartments properly warmed. In addition to this, all measures designed to improve general nutrition should be advised. The diet, as far as possible, should be non-nitrogenous. Within two or three years past the administration of preparations of the thyroid gland have met with considerable favor in the treatment of myxœdema. Results tantamount to cure have been reported by numerous physicians. It seems, however, that it is necessary to keep up the remedy for an indefinite period, as relapse follows its withdrawal. Administration by the stomach seems to be fully as efficacious as hypodermatically. The treatment must be followed with considerable care, as the use of too large doses is apt to be followed by unpleasant results. There are numerous reliable preparations of the thyroid gland now obtainable, some of them glycerin extracts and others powders. In any case, the minimum dose of the preparation used should be first exhibited, and its influence watched. This may be increased until a satisfactory degree of improvement is observed. It is said that the thyroid extract will produce a good effect even in cretinism. Several cases of myxœdema have been treated successfully by the engrafting of sheep's thyroid into the patient.

CONSTITUTIONAL DISEASES.

DIABETES.

Diabetes is a generic term including two well-defined affections, viz., diabetes insipidus and diabetes mellitus, diseases possessing marked clinical similarities. We are not yet in a position to fully define them, as their essential character is still shrouded in doubt.

Diabetes insipidus is an affection of unknown origin characterized by an excessive flow of urine of low specific gravity but free from sugar, while *diabetes mellitus* is characterized by the persistent passage of grape-sugar with the urine even when carbohydrates are taken in small quantities or not at all.

DIABETES MELLITUS.

History.—Diabetes mellitus was known to the ancients, being probably first described by Celsus. The presence of sugar in the urine of diabetic subjects was first suggested by an Englishman named Willis in 1674. Strictly speaking he discovered only the sweetish taste of urine, demonstration of the presence of sugar being accomplished by his countryman, Dobson, in 1775. Acting upon this as a suggestion, Rollo, another Englishman, began the treatment of diabetes by exclusion of vegetable food in 1787. Gmelin and Tiedemann discovered the formation of sugar during the digestion of carbohydrates. The extensive and protracted investigations of Claude Bernard to determine the nature of the disease were begun in 1848. Most important observations have also been made by Prout, Bouchardat, Brücke, Frerichs, Hoffmann, Ebstein, Naunyn, Seegan, Pavy and many other investigators of various nationalities.

Etiology.—Diabetes is one of the rarer forms of chronic disease, the more extended and carefully conducted methods of urinary analysis practised in recent days accounting for the apparent increase in its frequency. Diabetes may stand apparently alone or be associated with affections of the liver, pancreas, nervous system or lungs.

Heredity occupies an important position, several cases being often observed in the members of one family. The explanations of the influence of heredity are various. It seems to be especially prevalent among Hebrews. Frerichs, Bouchard, and others, have shown the importance, in estimating this question, of extending observations beyond the immediate ancestry, *i. e.*, to the near blood relatives.

Temperament. It is generally considered that the highly neurotic classes are more prone to the disease. I have not been impressed by this in the study of my own cases. Attacks have often followed upon sudden disturbance of the nervous system by fright, joy, etc.

Race. The frequency of diabetes among Hebrews has just been referred to, women who take little exercise and are given to the pleasures of the table being most frequently attacked. Negroes are seldom affected.

Country. Diabetes is generally distributed, but statistics suggest greater frequency of the disease in some countries. It seems to be especially common in Sweden and among Italians, particularly those residing in the southern portion of the Peninsula. It is also common in sections of India.

Social Condition. The larger number of cases develop among the so-called "well-to-do" class, in other words, among those who eat much and work little, which fact is antagonistic to the theory that the disease is dependent upon the excessive use of carbohydrates as food. Differences in relative frequency between the dwellers in cities and in rural regions may be largely accounted for by the earlier and more skilful observation bestowed upon the former class. Von Noorden states that "wealth and culture increase the liability to diabetes tenfold." That intellectual occupations conducted with great energy are powerfully predisposing is indicated by the large percentage of intellectual persons among diabetics.

Sex. Males are attacked about three times as often as females.

Age. No age is exempt, although the disease is rare under thirty. From a comparison of numerous tables of statistics it appears that the second decade of life gives three to seven times as many cases as the first, while there is little difference in the number of cases developed during the second and third decades; during the fourth the number is considerably increased, and is possibly still further increased during the fifth decade, the sixth giving about the same number, after which time there is rapid diminution in the number of cases.

The relationship of diabetes to affections of certain organs and to various forms of disease presents questions of great interest. It has been reported as resulting from a very large number of affections of widely separated organs and diseases. The long period of development of many cases, during which its existence is not suspected, is a source of much error in the formation of etiological conclusions.

There appears to be a connection between gout and diabetes, which has been pointed out by numerous English observers, in which country gout is a common affection. But as little is known of the causes of either gout or diabetes we can advance little further than the mere statement of fact, and no more can be asserted respecting the relationship existing between infectious diseases and diabetes.

Obesity. The relationship between obesity and diabetes is a close one; various observers stating the percentage of diabetic patients who are or have been fat, at figures varying from 15 to 50 per cent. Diabetes associated with obesity is called "lipogenous diabetes." A trace of sugar is found in the urine of some fat people, to which condition the term "lipogenic-glycosuria" is applied. The nature of the relationship is yet a matter of speculation. Von Noorden epitomizes his conclusions regarding this matter as follows:

"(*a*) There are cases in which the consumption of sugar and its conversion into fat are simultaneously restricted—glycosuria of varying degrees of gravity and emaciation (ordinary diabetes).

"(*b*) There are cases in which only the burning up of sugar, and not its conversion into fat, is interfered with—obesity with glycosuria (masked diabetes); these pass readily at a later period into

"(*c*) Cases in which the consumption of sugar is restricted, and the heaping up of carbohydrates in the fatty tissues is also more or less interfered with—obesity with consecutive glycosuria (ordinary diabetes of the adipose)."

Diseases of the Pancreas. Morbid changes in this gland have long been recognized as a feature of diabetes, but in 1877, after a study of much clinical and pathological material, Lancereaux described "pancreatic diabetes." The absence of any demonstrable lesion of the pancreas in many cases of typical diabetes, and the existence of extensive lesions without attending diabetes, are barriers to the acceptance of this theory, but may yet be explained. Bearing upon this point are the recent and highly interesting experiments of Von Mering and Minkowski, who observed glycosuria in dogs following upon extirpation of the pancreas. If but a small portion of the gland was allowed to remain sugar did not appear in the urine. This has been looked upon as indicating a double secretion by the pancreas, one of which, a glycolytic ferment with the lymph, is discharged into the blood to destroy the sugar. Those who oppose the pancreatic origin of diabetes assert that the disease is due under these circumstances to involvement of the solar and cœliac plexuses, and of the semilunar ganglia.

Excessive indulgences in food, especially that rich in hydrocarbons, favor the occurrence of diabetes, although it is not probable that any one kind of food can excite diabetes, but rather the persistent overtaxation of the liver by excessive amounts of food, especially of this character, acting upon a susceptible organism. Blows in the hepatic region have apparently excited some cases.

Syphilis. Some authors, especially Schnee, have credited syphilis with being the cause of most of all cases of diabetes. This extreme view is untenable.

Affections of the Nervous System. Diabetes is closely related to many

affections of the nervous system, so closely indeed that it is often impossible to determine which symptoms are primary. It is especially prone to develop in association with cerebral lesions, particularly tumors, hæmorrhage, meningitis, traumatism, and especially lesions involving the floor of the fourth ventricle. It is often associated with neurasthenia or hysteria.

R. Schmitz called attention to the possibility of *contagion* being a factor. Of his personal cases, which amounted to twenty-three hundred and twenty, he selected twenty-six, which he suspected to be due to this cause. They were persons of good family and personal histories, who developed diabetes after living in intimate relationship with subjects of this disease. Such a method of spread appears highly improbable.

Pathology.—It is impossible to state a theory of the pathology of diabetes which will be acceptable to a large majority, it being a subject concerning which much has been written, but which is still enveloped in considerable obscurity. Under these circumstances it seems best to simply state only what has been quite generally accepted as fact. This has been so admirably summarized by Silver that his statements are quoted *verbatim.* "Three important facts lie at the bottom of our knowledge of the pathology of diabetes. These are:

"I. That grape-sugar is found in the healthy human body.

"II. That glycogen, a substance closely allied in chemical composition to grape-sugar, is also found in the healthy human body.

"III. That both of these may be formed in the healthy human body. Beyond these, certain other fairly definite propositions may be made:

"(1) Glycogen is found most abundantly in the liver, insomuch that, with due precautions, it can always be detected there; after a certain time sugar takes the place of glycogen, but the exact mode and time of this conversion is not known.

"(2) Nevertheless, it is fairly certain that the sugar called glucose can always be detected in the liver; still more certain that it is to be found in the blood; but

"(3) This sugar never appears in any notable quantity during a state of health in the urine.

"(4) As sugar is not to be found in any appreciable quantity in any other of the excretions, it follows:

"(5) That this sugar must disappear in the body.

"(6) It is commonly asserted, and, upon the whole, believed, that sugar is less plentiful in venous than in arterial blood.

"(7) From this, if true, it follows that sugar must be used up in the course of the circulation.

"(8) Where the combustion or oxidation occurs is not quite clear.

"(9) But it is plain that, from a fault in either direction, sugar may

become overabundant in the blood, namely:—(*a*) By overproduction, or (*b*) By diminished consumption.

"(10) The overproduction and the diminished consumption of sugar in the body may depend on various causes. The most notable of these are (*a*) an increased ingestion of saccharine material into the stomach and bowels, without a corresponding destruction; and (*b*) such an alteration of nerve influence as will completely modify the relative proportions of the sugar produced and the sugar destroyed.

"(11) With an excess of sugar in the blood only one easy road of egress from the body is available, that is, by way of the kidneys; but this is not a sufficient outlet when there is great superabundance in the blood. Sugar may then be found in almost every one of the secretions or excretions.

"(12) With this unnatural discharge of sugar there is usually a corresponding discharge of urine, but not always.

"(13) Thus there may be no greatly increased flow of urine, yet the urine may be rich in sugar.

"(14) And yet, again, there may be a copious flow of urine without any sugar, as in *polyuria*.

"(15) Hence, the overproduction or the diminished consumption of sugar in the system has no necessary connection with increased flow of urine.

"(16) Both the abnormal action of the liver and that of the kidneys seem in the main to depend on similar but not identical causes.

"(17) Both seem to be under the control of the sympathetic, but the special fibres are not the same as regards the two organs.

"(*a*) In the case of the liver, the fibres seem to originate in the medulla oblongata, to descend in the spinal cord to the lower cervical or upper dorsal vertebræ, thence to leave the cord to join the gangliated sympathetic, and so ultimately reach the liver.

"(*b*) In the case of the kidneys, the active fibres proceed further down the spinal cord, but are ultimately connected with the great abdominal plexus, for such it may well be called, whence the fibres proceed to the kidneys."

Morbid Anatomy.—A very large number of lesions have been observed in association with diabetes, but we are not aware that it is characterized by any peculiar constant tissue change. This is particularly true of acute cases, in which the most careful autopsies do not reveal a cause of death nor the nature even of the affection from which the patient suffered. In this respect diabetes is like several other serious forms of disease. Many of the lesions observed are consequences of the disease; others are associations only and in no way related to the diabetes.

There is marked venous congestion of the various organs, viz., of

the brain, lungs, stomach, liver and kidneys. The lungs are often greatly engorged, dark and heavy, less frequently they are diminished, but still have a congested appearance.

Especial attention has been directed to the nervous system. In the brain, congestion, extravasations, anæmia, œdema, softening of the convolutions, sclerosis, atrophy, etc., are all occasionally met. Less often, many of these changes may involve the cord. The cerebral meninges may be thickened, hyperæmic or œdematous. More closely related to diabetes are tumors, both solid and cystic, involving the medulla and fourth ventricle. None of these lesions are constant, however. Emboli of glycogen are found in the small vessels in some cases, which may account for some of the nervous symptoms. Tumors involving the cranial nerves, vagus, sciatic or other portions of the nervous system, appear to act as exciting causes in some cases. The excess of sugar in the blood seems capable of creating a neuritis which involves more especially the spinal nerves and is the cause of "diabetic tabes." Enlargement and sclerosis of sympathetic ganglia are not rare.

The pancreas is altered in nearly one-half of all cases. The gland is usually small, indurated, anæmic, and may present contractions and nodulations. It has been found swollen by Silver, who considered it as representing an early stage of the organic changes. Fat necrosis, carcinoma, cystic disease, etc., are all occasionally present. Death from diabetes follows upon complete removal of the gland from dogs.

The liver is enlarged, dark, hard and frequently in a state of fatty change. Cirrhosis has also been described.

The kidneys are frequently diseased, especially after long existence of saccharine urine. The various features of nephritis and of amyloid degeneration may be observed in these cases. Hyaline degeneration of the capillary vessels, and of the tubular epithelium involving particularly the descending limb of Henle's loop, has been described. There may be glycogenic infiltration of the epithelium.

The lungs are ultimately involved in a large number of cases. Young persons and those of the poorer classes are more frequently attacked, and according to Lancereaux, those especially suffering from the pancreatic variety. The various forms of inflammation of the chest organs, viz., lobar and lobular pneumonia, bronchitis, etc., are met, but tuberculosis is the most frequent development. Many diabetics die of phthisis. The disease appears in mild as well as in grave cases. There has been some question as to the nature of the pathological lesion, but the bacillus tuberculosis is quite regularly present, although not always in the numbers observed in cases of the primary disease.

The gastro-intestinal tract may be catarrhal or contain erosions, ulcerations, or be pigmented.

The lower urinary tract may be involved, inflammation of the exter-

nal genitals, resulting from development of pyogenic microphytes in the saccharine urine, which remains in contact with the mucous membrane and the skin of neighboring parts.

The heart is often enlarged and may be fatty. The several inflammatory affections of this organ, and degenerative changes in the arteries are frequently observed.

The blood presents several interesting changes. The normal fluid contains about 0.15 per cent. of sugar, which, in diabetes, is increased to 0.3 or 0.4 per cent. It also contains, in some instances, innumerable fat molecules, which may give rise to lipæmic blood-clots in the vessels and the formation of a light-colored coat upon the coagulum of blood which has been drawn. Polynucleated leucocytes containing glycogen have been described.

General Clinical Course.—The development of diabetes is so insidious, and its progress so variable, that it is usually difficult or impossible to determine the time of beginning of the disease. It is not unusual to be able, upon its discovery, to determine quite positively from the history that it has already existed for months or years. I have repeatedly discovered its presence while making analyses of urine without expectation of such a result. It may be noted first that several varieties are now recognized, based upon its supposed etiology, the most prominent being *dietetic*, *neurotic* and *pancreatic*. The names proving a sufficient definition. These groups do not embrace all cases of diabetes, although attempts to establish other groups have been unsuccessful.

As already indicated, the onset may be insidious, attention being attracted to the nature of the disease by reason of persistence of copious and frequent urination, inordinate thirst, emaciation, etc. Less frequently it may develop rapidly, following upon some emotional disturbance, mental or physical overwork, traumatism, or some primary form of disease. With full development there are, in addition to these conditions, dry skin, brittle nails, vulvitis, or balanitis; or there may be general pruritus, various forms of skin eruptions, boils, carbuncles, or gangrene, which latter may develop in connection with wounds. The eyesight is often impaired, certain of the eye-muscles may be paralyzed, the sexual appetite diminished or gone, the general vigor greatly impaired, the tongue dry and red, thrush, intestinal catarrh, or destructive disease of the lungs may appear, and finally death from asthenia or coma.

The course of diabetes is usually chronic, but there are notable exceptions. It is commonly rapid in young persons in whom it frequently develops about the age of puberty. In one of my cases, developing in a girl of eleven years, death occurred in six weeks after the appearance of the first symptom. Life may be extended to six months or to one or two years. In these rapid cases there are usually first observed a sudden and

marked increase in the amount of urine with excessive thirst, hunger, nervous symptoms, and a moderate portion of sugar in the urine when compared with the quantity of the latter. The sugar steadily increases however and its excretion is but poorly controlled by the withdrawal of carbohydrates. The termination is likely to be by coma, or if life is sufficiently protracted, by tuberculosis. Death may result at any time by reason of intercurrent inflammation of some organ. A very few improve and are carried on into the more protracted form.

In the average case of severity the onset is less marked and the nature of the illness may be overlooked for some time. The most prominent group of symptoms is variable; it may prove to be any one of the marked conditions associated with this disease, viz., excessive urination, loss of flesh, general failure in strength, gastro-intestinal symptoms, nervous failure, pruritus, furunculosis, skin eruptions, affections of the eyes, loss of sexual ability, etc. The amount of sugar passed in the twenty-four hours is large and may amount to three, six, or more ounces. Rigid diet and general treatment may lead to great reduction in the amount of sugar, and a gradually increasing tolerance of carbohydrates, with protraction of the disease for some years, but in the majority toleration is little improved and after many fluctuations the disease proves fatal.

Mild cases are nearly always met in obese or gouty persons who have passed middle life and frequently exist for years before discovery. They suffer little except from privation in diet and occasional complications such as pruritus, boils, carbuncles or a peripheral neuritis. Good habits, careful husbanding of the physical and mental powers, a sufficiently rigid exclusion of carbohydrates to remove or reduce the sugar in the urine to a nominal amount, often result after a time in the ability to take a small amount of this character of food, the prolongation of life for many years in comparative comfort, and with the ability to perform the more important duties of a business or professional life.

Even the mild form may be quite rapidly transformed into a malignant one by excessive fatigue, either mental or physical, by a severe attack of intestinal catarrh or intercurrent affection of some kind. Pregnancy is unfavorable, often terminating in abortion or rapid progress of the disease after delivery. When associated with disease of the pancreas, nutrition is seriously disturbed, with rapid emaciation and an early conclusion. That form which occurs as a sequence of traumatism of the nervous system may be rapid in its development, but often disappears soon, or the evolution is gradual with the establishment of the ordinary protracted variety.

Urine. The urine is usually greatly increased, four, six or eight pints in the twenty-four hours being quite common. These amounts may be increased to twenty, thirty or forty pints in rare cases of high grade,

and with about equal rarity the amount is little or not at all increased. Increase in the quantity of urine is more rapid than increase in the amount of sugar, which is observed in the incipiency of cases as well as during aggravations in cases of long standing. During rigid treatment, and in the course of intercurrent acute disease, the amount may be reduced for a time to about normal. The amount passed during the night is not usually as great, which is in marked contrast to other affections marked by polyuria, in which the greater quantity is usually passed at night (Quincke). Polyuria may continue after the disappearance of sugar from the urine, due in some cases to the continued habit of excessive drinking. The urine is pale, has an odor resembling that of fruit, a sweetish taste, is of acid reaction, often highly so, and of a specific gravity which varies from below normal to 1045. The specific gravity is affected by the quantity of urine, *i. e.*, the greater the quantity the higher the specific gravity. The high specific gravity of diabetic urine is due not alone to sugar but to the products of the large amount of nitrogenous food ingested. The specific gravity diminishes when the urine is preserved for some time, as the result of vinous fermentation, which transforms the sugar and disengages alcohol. The amount of sugar contained in the urine varies from a mere trace (and in some cases it may be at times entirely absent) to 4, 6 or even 10 per cent. In cases of slight intensity the amount varies from 1 to 2 per cent. The total quantity of sugar voided during twenty-four hours may amount to several pounds. Tests for the presence of glucose in the urine are detailed on page 351.

The amount of urea excreted is increased in proportion to the seriousness of the disease, but diminishes in the later stages with the general depression of nutrition and of retrograde metamorphosis.

Uric acid is seldom much increased except in gouty individuals, who may pass large amounts.

A "diabetes alterans" has been described in which excretion of sugar alternates with that of uric acid, but I have corroborated the statement of Ralfe "that uric acid, if anything, is increased in diabetes, and that its deposition from the urine when the amount of sugar excreted is diminished or entirely checked, by diet, really means that the diuresis being less, the urine is more concentrated and consequently the tendency to throw down uric acid and urates is increased."

The free use of animal food results in an excretion of a large amount of creatinin.

The discharge of ammonia is much increased, which is probably the result of the acid diet of diabetics. The phosphoric acid formed from the large amount of meat taken uniting with ammonia prevents its union with carbon-dioxide to form urea. The phosphates are also increased, which is, in a measure, due to the diet, but also to excessive metamorphosis of the nitrogenous portion of the tissues.

Albumin often appears in small amounts and without coexisting evidence of renal degeneration. It is never large, even in the late stage, when the diabetic symptoms are replaced by those of chronic interstitial nephritis.

Acetone, which is, in all probability, developed through retrograde metamorphosis of albumin, is thought to be a product of aceto-acetic acid. Oxybutyric acid is a near relative and will be seen to be of importance prognostically. Acetone is a limpid liquid without color, and possessing an etherial odor. If ferric chloride is added to urine containing it, a dark-red tint results. It is found not only in the urine of diabetes, but in that of some dyspeptics or those suffering from malignant disease, especially cancer of the stomach. It seems to be quite decided that the appearance of acetonuria and diaceturia in diabetics is an indication of failing nutrition and that a further lowering of the nutritive standard is likely to culminate in coma. The continued excretion of oxybutyric acid for many days is strongly indicative of the imminence of diabetic coma.

Alimentary Tract. There is a strong tendency to inflammation of the mucous surface manifested by a considerable frequency of catarrhal and aphthous stomatitis, and of catarrh of the stomach and bowels, giving rise to prominent symptoms and constituting serious features of the disease. Aphthæ are formed by the acidity of the secretion of the mouth which is a quite constant condition in this disease. The gums may inflame, ulcerate, and the teeth become carious or drop out. While these changes are due to invasion by micro-organisms, the loss of teeth is the result of a trophoneurosis. As in the case of the skin, pathological changes are here largely preventable by cleanliness. Dilatation of the stomach is common and the consequence of inordinate drinking and eating, which also leads to enfeeblement of the muscular coat, retention of gastric contents, and impaired nutrition. The gastric glands atrophy, with diminution of hydrochloric acid, which may finally disappear. The appetite is often excessive, which is the result, mainly, of the great loss which the patient is constantly sustaining. Gastralgia is a feature of some cases, and less often, gastric ulcer.

The high degree of constipation emphasized by some observers I have not found very common, although persistent constipation leads to the development of poisonous substances and auto-infection. Diarrhœa may result from excessive or improper eating and drinking, and must be looked upon as a serious accident. Many a diabetic who has progressed favorably for a long time speedily succumbs to an accidental and often a neglected attack of diarrhœa. Diabetic coma is a common sequence, but whether excited by irritants generated in the intestine, or by the depressing influence of the attack is not certain.

The liver may be a little enlarged, due to the hyperæmia, and in obese persons this may be increased by fatty accumulation.

Involvement of the pancreas is not always readily determined by the symptoms. A tumor may be felt, but this is unusual. The stools may contain fat (steatorrhœa), and be very offensive. Colic resembling that attending calculi (Lichtheim), sometimes attends, or maltose is found in the urine.

Pulmonary Organs. The lesions of tuberculosis progress rapidly and are highly destructive. There is nothing peculiar in the attending symptoms. I have observed serious hæmoptysis repeatedly, which is contrary to the statements of some observers. Bronchitis and fibrinous and catarrhal pneumonia are all encountered and any of them may terminate in gangrene. Gangrene occurs especially in rapidly progressive cases and is preceded by cough and other symptoms of pulmonary disturbance. It is heralded by offensive sputum which is of a dirty brown or grayish color. Physical signs are of little value unless the area involved is large. The diagnosis must therefore depend upon the general symptoms coupled with the offensive sputum. Recovery may take place if the lesion is of limited area and the glycosuria can be improved. The breath sometimes has an odor of apples with an offensive taint.

Heart. The heart may hypertrophy if the patient's nutritive state is good (a conservative process), followed by dilatation; but more frequently, according to Frerich's careful post-mortem investigations, the heart-muscle atrophies, the cavities dilate, or the heart's walls infiltrate with fat. These changes are more frequent among those who are much depressed in strength. Feeble heart is therefore a prominent symptom of many cases. Sudden failure of the heart is not rare, often occurring without evidence of a previous lesion, coma, or general failure, and may be precipitated by diarrhœa, emotional or physical causes.

The heart's action may be accelerated, slowed, or manifest rhythmic disorder.

Arteries. A well-marked arterio-sclerosis is a common feature. It may be discovered in the early stage of the diabetes, or developed as a premature senile change late in its course. When observed early it may have preceded the diabetes, and according to many is a probable cause of the diabetes, acting through nutritive changes in the nervous system, pancreas, and possibly other organs.

Endocarditis is not unusual and is excited by the irritant action of the sugar-laden blood.

Nervous System. The most remarkable feature of the disease associated with the nervous system is coma. We are indebted to Kussmaul for the first description of "diabetic coma" which is the form of termination of one half of all fatal cases. Of its true nature we are still ignorant after twenty years of research and speculation, absolutely nothing being discovered post-mortem to explain the condition. It may be precipitated

by unusual exertion, emotion, or mental strain. The symptoms resemble those of narcotic poisoning, especially alcoholism, and are preceded for a few hours or days by a variety of symptoms of nervous irritability, particularly headache, vertigo, anxious restlessness, twitching of muscles, etc. These are followed by somnolence, all motions are slow, the pupils dilated, inspiration is protracted and noiselessly performed, the pulse is small and weak, not much increased in frequency, and the temperature depressed, although in the early period it may be elevated. The reflexes are abolished. There is a peculiar odor of the exhalations likened to chloroform (acetone). The urine gives a rich wine color on the addition of chloride of iron. There may be nausea, vomiting and diarrhœa, and dyspnœa without appreciable reason. This condition continues with increasing stupor or periods of improvement until death occurs, which is seldom delayed longer than two or three days. It is important to distinguish between diabetic coma and that due to uræmia, cerebral hæmorrhage or failing heart, all of which may occur in the terminal stage of diabetes. It is also of importance to know that sugar may be absent from the urine and lead to difficulty in diagnosis when the patient is seen for the first time after the development of coma.

The highly enfeebled and irritable condition of the nervous system is the basis of development of this coma, also the cause of the general debility, muscular feebleness and many other symptoms, but whether the exciting cause of some or of all cases of diabetic coma is an intoxication, or the influence of the exciting causes named upon the deteriorated nervous system, has not been determined. The cause may not be always the same. Coma may be looked for if the amount of urine is diminished without a similar ratio of diminution in the quantity of sugar it contains. Excessive exertion or mental emotion has been referred to as an exciting cause, to which may be added various forms of intercurrent disease.

Peripheral neuritis is the cause of many features of diabetes which were until recently attributed to disease of the central nervous system. It may appear early, especially as manifested in neuralgias and affections of the eyes. The sensory developments are the more important, and consist of various alterations of sensation, cramps and neuralgia. The latter are intractable unless the diabetic condition responds to treatment Symptoms resembling locomotor ataxia, and called "pseudo-locomotor ataxia," but which are not due to central disease, have been observed. Trophic changes may lead to ulcerations, loss of teeth, hair, or nails, or to skin lesions, gangrene, etc. Motor disorders may appear in the form of paralysis or ataxia, with atrophic changes in the muscles. The areas supplied by the crural nerves and certain of the nerve filaments of the eye are most frequently involved. The reflexes diminish or disappear in nearly one half of all cases. Their disappearance is not permanent in all instances, which diminishes the value of this symptom for

prognostic purposes. Exaggerated reflexes suggest disease of the central nervous system, to which, indeed, the diabetes may be due. The etiological influence of lesions involving the fourth ventricle of the brain has been considered.

A variety of psychic disorders has been noted, varying in their character from simple weakness of the faculties, or neurasthenic or hysterical symptoms, to melancholia, but in the great majority the mental faculties remain for years, and usually to the close, but little or not at all impaired. Aside from paralysis of ocular muscles mentioned, there may be failing vision from glycosuric amaurosis, cataract, premature presbyopia, etc. Some form of retinitis develops in about one case in six.

Skin. The cutaneous surface is usually dry and responds poorly to the action of remedies which produce sweating. The occasional profuse sweatings are probably due to various sources of irritation of the nerves governing the secretion of the skin. The sweat may be rich in sugar and contain lactic acid, constituting a highly irritating fluid, which is in some degree responsible for the various diseases of the skin which are so prone to develop, notably, pruritus, erythema, eczema, herpes, psoriasis, lichen, etc. Pruritus is more apt to appear in cases with much activity of symptoms and is attributed to dryness of the epithelium and consequent irritation of the cutaneous nerve filaments. Such irritation may be in part due to the direct action of sugar, and, according to some observers, to central irritation.

The localized pruritus involving the genitals is much more common in women, especially uncleanly women, whose habits permit the vulva and adjacent parts to become frequently moistened by the saccharine urine, an excellent soil for the development of hyphomycetes, which even penetrate between the epithelia. This source of irritation in conjunction with mechanical forms, such as scratching, leads to inflammatory affections varying from simple dermatitis to boils and more extended phlegmonous processes in the deeper structures. Men complain of itching at the meatus or about the scrotum and may develop a balanitis with resulting phimosis. Whether the boils, carbuncles and more severe lesions extending from the cutaneous surface are due in all instances to the penetration of micro-organisms is uncertain. As to the conditions favoring inflammatory affections in the diabetic we can only surmise that the saccharine blood and tissues offer a most favorable soil for the development of the organisms of suppuration. Furunculosis is not peculiar to grave cases, but often appears in those of slight intensity.

This strong tendency to inflammation followed by destructive changes causes injuries and surgical operations to be attended by a high degree of danger. Much may be done to prevent cutaneous and subcutaneous lesions by giving attention to strict cleanliness of the skin. Surgeons have greatly lessened the mortality from operations in this class by the strict application of antiseptic principles.

Prognosis.—The progress of the disease is determined mainly by the amount of sugar in the urine, which is an excellent guide, up to a certain period of the disease, when the amount of sugar may lessen and disappear entirely for weeks prior to death. I have observed complete absence of sugar for a period of several months before the fatal issue. Such a diminution or disappearance of glucose from the urine may deceive the friends and even the attendant if other symptoms are not taken into consideration. It is better that the prognosis be always guarded, as we have seen that even mild cases may under unfavorable circumstances become malignant at any time, while others, even of the acute variety, may be controlled to a considerable degree and take position in the chronic group. The diabetic individual, apparently well nourished and performing quite active duties, "may be aptly compared to some tower, its downfall is assured, but none can tell when the catastrophe will occur." Persistent excretion of a large amount of sugar, the discharge of which substance is not much under the control of diet, is of ill omen, and still more the presence of oxybutyric acid in the urine which is soon followed by coma. A development in early life is most unfavorable, also rapid progress of asthenia and loss of flesh, especially if associated with a family history of other cases of diabetes which have pursued a swift course. Inability to procure or carry out proper treatment, or to avoid strain of mind or body, is the cause of rapid progress in many cases.

A moderate or small amount of sugar in the urine which is readily diminished or removed by diet, and an increasing tolerance of carbohydrates, are the most favorable indications. Cases resulting from traumatism or syphilis, or which develop in fat persons after middle life, are most favorable, also those associated with gout, although in this class the diabetes may ultimately disappear and be replaced by chronic interstitial nephritis. Refractory subjects who will not carry out instructions, or are without fidelity, can hope for little. Cases due to excessive ingestion of food are usually tractable. In all cases the condition of the digestive organs must be carefully determined, the most important disorder being intestinal indigestion, which is often associated with pancreatic disease and is frequently followed by coma. According to Lancereaux, a malignant course, rapid loss of flesh and development of pulmonary complications, suggest the pancreatic form, to which Von Noorden adds tumor of the pancreas, severe colic, not referable to the liver or kidneys, and so located as to suggest a calculus in the duct of Wirsung, excretion of maltose in the urine, steatorrhœa without jaundice and azotorrhœa.

Treatment.—Something may be accomplished in the direction of prophylaxis. Persons in whose families diabetes has claimed victims or who are inclined to obesity should moderate the amount of carbohydrates taken, live in a regular manner, avoiding excesses of all kinds, and spend much time in the open air. Too rigid dieting or too energetic

methods for the reduction of fat should be avoided, as they may impair nutrition and precipitate that which they were intended to prevent.

For the control and cure of diabetes no means is comparable with a proper degree of exclusion of the carbohydrates from the food. In many cases improvement continues only so long as articles of this description are excluded from the dietary, but in others, a return to this element will be followed by a smaller amount of glucose in the urine, thus demonstrating that tolerance of carbohydrates is often increased by their withdrawal for a time. In mild cases dietetic methods may be sufficient for a cure.

It is wise to determine, before instituting a course of treatment, the patient's degree of toleration of carbohydrates, which is accomplished by excluding them as perfectly as possible from the dietary and after the disappearance of glucose from the urine or its reduction to the smallest amount possible, slowly adding them again to the diet in small definite quantities, with careful observation of their influence upon the amount of glucose in the urine. By this plan it is often discovered that a certain percentage of carbohydrates is tolerated without glycosuria resulting or without increase of the small and quite fixed amount of sugar in the urine.

The importance of individualizing the diet of each case is considerable, as many present elements other than the diabetic one for consideration. Modification may be required by digestive or nervous disorders or by associated nephritis, and it is often necessary to compromise in securing food best suited to both the diabetes and the associated nephritis or other complicating condition. In exceptional instances improvement is observed upon the use of food which is theoretically excluded, *e. g.*, Fothergill tells of a physician who was apparently much benefited by raspberry jam, and I have observed equally striking results from articles which are ordinarily harmful.

In the effort to exclude carbohydrates it is necessary first of all to prohibit the use of starch and sugar, which articles contain most of the objectionable element ingested. When circumstances permit, the change in diet should be gradually made, as the system thus accepts it more kindly.

The craving for bread is usually strong, often leading to deception on the part of the patient in order to obtain it. Many articles have been substituted for it, but with only partial success. Bread prepared with gluten flour has been most employed, but all the gluten which is procurable contains much starch. Potatoes contain much less, and in suitable cases may be eaten in small quantities, or be incorporated in bread, thus lessening the percentage of starch. Almond flour, commended by Pavy, contains only 6.0 per cent. of carbohydrates, but is too expensive for general use.

Fats may be taken freely in the form of fat meat, cream, butter and oils, especially that of the cod-liver; also sardines or those in oil, or *pate de foie gras.* They frequently improve the nutrition, especially in the neurogenous form. Caviare is recommended by Dujardin-Beaumetz as of much value in the late stage, exciting appetite and protracting life. Fats are better tolerated if some alcoholic is allowed.

The great thirst demands a large amount of fluid of which water is most important; it may be taken pure or charged, or in the form of some alkaline mineral water. The least objectionable forms of alcoholic drinks are those which contain the least sugar, consequently claret, burgundy, dry sherry, hock and moselle. Occasionally old brandy or whiskey may be used sparingly. They should all be well diluted with water and taken with meals. Alcoholics not only give greater tolerance of fats, which are so important for the diabetic, but influence favorably the feeble heart and nervous system.

Coffee, tea and cocoa are permissible if taken without sugar. Saccharine or levulose may be substituted. The former should be used only in small quantities or it will irritate the digestive tract. Honey may be used in small amount and the effect noted.

Diet lists should be carefully prepared and furnished to patients, to be added to or subtracted from as continued observation directs. The dietaries of Sir William Roberts and of Seegen are given as representing those employed by most distinguished observers.

DIETARY OF SIR WILLIAM ROBERTS.

SANCTIONED.	FORBIDDEN.
Butchers' meat.	All saccharine and farinaceous foods.
Poultry and game.	Bread, potatoes.
Fish.	Rice, tapioca, sago, arrowroot.
Cheese.	Macaroni, etc.
Eggs.	Turnips, carrots, parsnips, beans, and peas.
Butter, fat and oil.	Liver (contains much sugar-forming substances), and therefore
Broths, soups and jellies, made without meal or sugar.	Oysters, containing enormous livers.
Cabbage, endive, spinach.	Cockles.
Broccoli, Brussels sprouts.	Mussels.
Lettuce, spring onions.	The "pudding" of crabs and lobsters.
Watercress, mustard and cress.	All sweet fruits, as apples, pears, plums, gooseberries, currants, grapes, oranges, etc.
Celery.	
Substitutes for Bread:	
Bran cake, gluten bread (and meals), almond meal, rusks and biscuits, "torrefied" or charged bread.	

BEVERAGES.

Dry sherry, claret, bitter ale.	Port and all sweet wines.
Brandy and whiskey (in small quantities).	Sweet ales and porter.
Tea, coffee (no sugar), chocolate (made with gluten meal), soda water, bitartrate of potassium water.	Rum and sweetened gin.

SEEGEN'S DIETARY.

SANCTIONED.	FORBIDDEN.
In any quantity.	Farinaceous foods of all kinds.
Flesh of all kinds; preserved (smoked) meats, ham.	*Bread only in very small quantity, according to the discretion of the physician.*
Tongue, bacon.	Sugar.
Fish of all kinds.	Potatoes, rice, tapioca.
Oysters and shell-fish.	Arrowroot, sago, groats.
Crabs, lobsters.	Peas, beans.
Animal jellies.	Sweet fruits, as grapes, cherries, peaches, apricots, plums, and all kinds of dried fruits.
Eggs, caviare, cream, butter, cheese.	
Spinach, cooked salads, endive.	
Watercress, sorrel.	
Artichokes, mushrooms.	
Nuts.	
In small quantity.	
Cauliflower, carrots.	
Turnips, white cabbage.	
Green beans.	
Berries, such as strawberries, raspberries, currants; also oranges and almonds.	

BEVERAGES.

SANCTIONED.	FORBIDDEN.
In any quantity.	Champagne and sweet wines and beers, fruit-wines and fruit-juices and syrups.
Water, soda-water.	Sweet lemonade.
Tea, coffee.	Liqueurs.
Bordeaux, Rhine, and Moselle wines.	Ice and sorbets.
Austrian and Hungarian table-wines; in short, all wines that are not sweet, and that contain only a moderate amount of alcohol.	Cocoa and chocolate.
In very small quantities.	
Milk, unsweetened.	
Almond emulsion.	
Brandy, bitter beer.	
Lemonade, unsweetened.	

The convenient diet list of Professor A. Flint, which is appended, I have employed for many years, with satisfaction:

Breakfast.—Oysters stewed, without milk or flour; clams stewed, without milk or flour; beefsteak, beefsteak with fried onions; chicken; mutton or lamb chops; kidneys, broiled, stewed, or deviled; tripe, pig's feet, game, ham, bacon; deviled turkey or chicken; sausage, corned beef; hash without potatoes; minced beef, turkey, chicken, or game, with poached eggs; all kinds of fish, fish-roe, fish-balls without potatoes; eggs cooked in any way, except with flour or sugar; scrambled eggs with chipped smoked beef; picked salt codfish with eggs; omelettes plain or with ham, with smoked beef, kidneys, asparagus points, fine herbs, parsley, truffles, or mushrooms; radishes, cucumbers, watercresses, butter, pot-cheese; tea or coffee, with a little cream and no sugar; light red wine for those who are in the habit of taking wine at breakfast.

Lunch, or tea.—Oysters or clams, cooked in any way except with flour or milk; chicken, lobster, or any kind of salad except potato; fish of all kinds; chops, steaks; ham, tongue, eggs, crabs, or any kind of meat; head-cheese; red wine, dry sherry, or Bass's ale.

Dinner.—Raw oysters, raw clams; soups, *consommé* of beef, of veal, of chicken, or of turtle; *consommé* with asparagus points; *consommé* with okra, ox-tail, turtle, terrapin, oysters, or clams without flour or milk; chowder, without milk or potatoes; mock turtle, mullagatawny, tomato, gumbofilet; all kinds of fish; lobsters, oysters, clams, terrapin, shrimps, crawfish, hard-shell crabs, soft-shell crabs (no sauces containing flour or milk); pickles, radishes, celery, sardines, anchovies, olives; all kinds of meat cooked in any way except with flour; all kinds of poultry, without dressings containing bread or flour; calf's head, kidneys, lamb-fries, ham, tongue; all kinds of game; veal, fowl, sweet-breads, etc., with currie, but not thickened with flour (no liver), truffles, lettuce, romaine, chickory, endive, cucumbers, spinach, sorrel, beet tops, cauliflower, cabbage, Brussels sprouts, dandelions, tomatoes, radishes, oyster-plant, onions, string-beans, watercresses, asparagus, artichokes, Jerusalem artichokes, parsley, mushrooms; all kinds of herbs.

Substitutes for Sweets.—Peaches, preserved in brandy, without sugar; wine-jelly, without sugar; *gelée au kirsch*, without sugar; *omelette au rhum*, without sugar; *omelette à la vanille*, without sugar; *gelée au café*, without sugar. Butter, cheese of all kinds; almonds, hazelnuts, walnuts, cocoanuts; tea, or coffee, with a little cream, and without sugar.

Little confidence is expressed in the medicinal treatment of diabetes; nevertheless there is an abundance of evidence that remedies do influence favorably the amount of sugar in the urine, that they control symptoms and improve the general condition of health. By most, too much attention is riveted upon the sugar in the urine and the relation of medicinal agents to it, too little upon the general condition of the patient. Indications furnished by the digestive, nervous and circulatory systems are of the highest value and should never be ignored. Some of the most favorable results I have witnessed have been from the action of medicines which, as far as we know, do not possess urinary symptoms resembling diabetes. The pathology of this disease is so broad that the range of medicines employed must be correspondingly great. One must look beyond sugar in the urine for indications which will lead to the successful application of medicine.

Phosphoric acid is of first importance in the treatment of neurogenous cases. Diabetics presenting pronounced nervous exhaustion sometimes respond promptly to its action, especially those who have recently lost much flesh and are poor in both mental and physical force, persons who have overworked, had much trouble, or been given to sexual excesses. They pass large amounts of highly saccharine urine, rich in phosphates or oxalates, are desponding and without hope of improvement. Their mental state is one of apathy and they may seem to care little whether they improve or not. *Phosphorus* appears to be more valuable in older persons, manifesting degenerative changes in the circulatory system, or fatty degeneration, either general or localized.

Uranium nitrate. Has been highly commended by Jousset, Hughes and other eminent clinicians, and a number of supposed cures resulting from its use have been reported by a variety of observers. It appears best suited to cases with associated digestive or assimilative troubles. I have assured myself of its influence by prescribing it after the glycosuria

had been reduced to the smallest amount possible, or had been removed by dietetic and general measures. The provings exhibit its ability to excite glycosuria and a variety of symptoms suggesting its use. *Aurum muriaticum* is also a valuable medicine for cases of the neurogenous form, especially for neurasthenic or hysterical subjects. Persons who complain of many subjective symptoms of the nature of morbid sensations, apprehensiveness, fear of going out alone, etc., etc. This is the opposite of the mental condition of the phosphoric acid patient. Syphilis and arterio-sclerosis strongly suggest its use. *Arsenic* is most useful in cases attended by symptoms associated with the gastro-intestinal tract, and sometimes assists in arresting acute cases attended by rapid loss of flesh and strength. Anæmia may be pronounced, and there may be skin eruptions, carbuncles or gangrene. The general indications for this medicine, viz., great thirst, restlessness, anxiety, dyspnœa, etc., with nightly aggravation, often call for it independently of local indications. Arsenic often acts well in minute doses, while in others, Fowler's solution in drop doses, repeated every two to four hours, is much more useful.

Plumbum, or *plumbum iodide* is sometimes called for by the symptoms. I have had the best results in gouty individuals when the urine contained uric acid crystals, small amounts of albumin and a few tube casts; in pathological terms, for diabetics who are developing interstitial nephritis. Lead is, however, useful in diabetes pure and simple. The iodide is apparently the more active agent.

Nux vomica, bryonia, leptandra, podophyllum and *lycopodium* are called for by symptoms associated with the digestive system; *nux vomica* for the irritable constipated dyspeptic (it may be necessary to administer freely in the tincture); *leptandra* when there is an empty feeling at the epigastrium, although eating causes a sense of fulness, so that he is "full and empty at the same time" (Laning); general symptoms of portal congestion; *podophyllum* for light stools, sensation about the liver causing him to rub and stretch the side, head heavy, tongue heavily coated; *lycopodium*, flatulency, sense of fulness after food, discomfort in the right hypochondrium, constipation, uric acid crystals in the urine; *bryonia*, great thirst for large quantities, dry mouth and throat, bitter taste even after all food and drink, pain in the right hypochondrium, easier from lying on the right side.

Creasote. I have found this remedy of great value in many cases complicated by tuberculosis, not only checking the cough, expectoration and lung destruction, but sometimes lessening decidedly the amount of sugar in the urine. It has been generally used by inhalation—as directed for pulmonary phthisis—but the inhalation should be repeated three times daily, not once as stated in that connection, which statement was due to an error in the manuscript. Creasote is especially valuable when

there is gastric irritability, flatulency and rapid emaciation. *Lactic acid* has been recommended for acid gastric symptoms, high degree of hunger and thirst. The quantity of urine is large. *Ferrum phosphoricum* is useful in young subjects with developing tuberculosis, also *calcarea phosphorica*. *Calcarea carb.* when the gastric and general symptoms were present. *Silicea* 6x, persistently administered, gave an excellent result in a case with the characteristic constipation and sweating of this remedy. The *arsenite of strychnine* has proven valuable when the nervous system was at fault, the patient being exceedingly weak and irritable. *Mercurius* and *kali hydriod.* are often helpful in syphilitic cases, but the free use of antisyphilitic remedies in large doses has not been followed, as a rule, by good results. *Arsenite of bromine, kali bromatum* and *asclepias vincetoxicum* have been used with some success. The recent experiments with *phloridzin* by von Mering and others indicate its ability to develop saccharine urine. It should be studied as a possible remedy.

Little can be accomplished for the coma. Following Fagge, many have practised intravenous injections of bicarbonate of sodium, but without much success; but the fact that some have secured a return of consciousness for a time is interesting and may be utilized. Inhalations of oxygen I have found valuable, and they may give the same result.

Old-school therapeutics gives us little of value. *Morphia* or *codeia* is most used, the doses being increased to five or six grains daily. They are really valueless without strict attention to diet, which statement is approximately true regarding the influence of all medicines. The *salicylates, nitro-glycerin, salts of lithium, creasote, jambul* and *lactic acid* are also employed, but reports as to their value are not encouraging.

Use of Mineral Waters. The alkaline springs, such as Vichy, Carlsbad and Marienbad; or saline springs, such as Kissingen, are much employed and with some degree of good result. Aside from any direct influence of the water, the patient is benefited by relief from domestic or business cares, lives in the open air, exercises considerably and has the diet carefully regulated. It is in this manner only that some patients can be induced to give careful attention to the items of treatment.

DIABETES INSIPIDUS.

Synonyms.—Polyuria; diuresis; hydruria; polydipsia, etc.

Diabetes insipidus is a constitutional affection of unknown origin, the special features of which are a large increase in the amount of urine excreted (polyuria) and a corresponding increase in thirst (polydipsia). The urine does not contain glucose, and albumin only after secondary disease of the kidneys has developed.

Etiology.—Being in ignorance as to the cause of this affection, it is only possible to state its relationship to conditions supposed to possess some influence upon its development. While some observers state it to

be a disease of adult or middle life, of the 85 cases collected by Strauss, 57 occurred in persons under twenty-five years; 21 under ten years, and 9 under five years of age. In 35 cases occurring in children, collected by Kuelz, 2 developed during the first year of life.

Males are attacked much more frequently than females; at least, in the ratio of three to one. Heredity possesses some influence, as the rare observation of a large number of cases occurring in several generations in one family has been noted; and the coexistence of diabetes mellitus and diabetes insipidus in the same family, which has been repeatedly observed, suggests a pathological relationship between these affections. It probably occurs more frequently in neurotic individuals or those coming from families in which nervous affections or insanity have prevailed. Diseases or traumatism involving the nervous system are probably the most frequent pre-existing, and, possibly, exciting factors in the development of diabetes insipidus. Of these we may mention injuries to the head or spine, or, indeed, to any portion of the nervous system; also, inflammation of the meninges, or inflammation, tumors or degenerative changes of the brain or spinal cord, especially such as involve the floor of the fourth ventricle, which region is closely related to polyuria, as shown by the experiments of Claude Bernard and later investigators, who were able to produce polyuria by injury of the floor of the ventricle at a point a little higher than that exciting saccharine diabetes. Sections of the spinal cord at a lower level than the twelfth vertebra, and of certain nerve trunks have also excited polyuria.

It has appeared as a sequence of various infectious diseases, particularly diphtheria, scarlatina and malarial fevers. I have observed it after measles. Of chronic affections, phthisis and syphilis most frequently precede it, while it has been observed in association with tuberculous peritonitis and various forms of abdominal tumors. Lead poisoning and alcoholism have also been thought to excite it.

The development of the disease after exposure to cold or drinking quantities of cold fluids, exposure to great heat, sunstroke, great emotional disturbance, etc., has been noted, but the etiological relationship of many of these conditions is very doubtful, for, as Silver remarks, they are doubtless assigned on the *post hoc* principle.

Morbid Anatomy.—No lesion can yet be considered characteristic, although, as we have seen, its more important pathological associations are with the nervous system. Aside from those conditions mentioned in considering the etiology, degenerative changes involving the solar plexus have been observed, apparently dependent upon connective tissue hyperplasia. The kidneys may be large, distended with blood, and the urinary tubules and accessory passages, including the bladder, dilated. The latter may be hypertrophied.

Symptoms.—The onset is usually very gradual, although in a few

cases the symptoms appear suddenly after the action of some exciting cause, but in such cases it is possible that the disease has existed for a period of time prior to the pronounced symptoms. The most important feature is the increased excretion of urine. The amount is variable. Mild cases will pass six to eight pints per day, while in those of a more serious character this may be increased to fifteen or twenty or even forty pints. These excessive amounts are rare, however, even in rapidly fatal cases. The passage of such large quantities of urine demands the taking of corresponding amounts of water and increased frequency of micturition.

The urine is pale yellow and may be as clear as spring water. The reaction is acid but may soon become neutral or alkaline and turbid, due to products of the mucous surface which are thrown off in consequence of irritation excited by the altered urine. The specific gravity varies from 1008 or 1010 to that of distilled water. The solids are increased, particularly urea. An excretion of two or three ounces of this substance in the twenty-four hours is not rare. Uric acid is about normal. The phosphates and chlorides are increased. It is claimed that, for a short period of time, the amount of urine excreted may exceed that taken which requires that the tissues should give up some of their water.

Increase of thirst is a constant and most distressing symptom and is attended by a dry, pasty condition of the mouth and throat. The thirst is so great that sufferers, especially children, have been known to drink their own urine. The polydipsia is secondary to the polyuria, although rare instances have been reported of its development as the primary symptom.

The appetite is voracious and perverted in well-developed cases, but general enfeeblement and emaciation are progressive. In other cases the appetite is impaired. The skin is dry, branny, may itch intolerably and be the seat of paræsthesiæ or furuncles. The temperature is abnormally low and there is chilliness and coldness of the extremities due to general loss of vitality and of heat in the warming of the large quantities of fluid taken. The taking of so much water and food causes disorders of disgestion. Constipation is a common symptom. There may be headache, vertigo and inability for continued mental work; various cranial nerves may be paralyzed, the reflexes may be impaired, different eye troubles may occur, such as neuro-retinitis, retinal hæmorrhages, hæmianopsia and optic nerve atrophy. Impotence is present in most cases and may develop at an early stage of the disease.

The progress of diabetes insipidus may be very rapid, but this is very exceptional. In general, the time of onset cannot be determined, so gradual is the development of the disease. Marked remissions may occur which must be remembered in estimating the effect of therapeutic measures. These are sometimes observed in the course of some inter-

current affection. Aggravations may be developed by intercurrent disease, excess in mental or physical work, sexual excesses, etc. The milder cases may last many years, even a lifetime, the patient having a healthy appearance. When occurring in early life, development may be arrested. Death takes place from the exhausting influence of the disease or from some primary or intercurrent affection such as phthisis. It may be preceded in some instances by tremor, convulsions, and finally coma.

Diagnosis.—It is most frequently necessary to distinguish between true polyuria and those excessive temporary flows of urine incident to nervous conditions, hysteria, the use of large quantities of fluid or of diuretic substances, and convalescence from protracted infectious disease. The temporary character of the flow from these causes, also when a hydronephrosis discharges, or a large dropsical or serous cavity effusion is rapidly absorbed, serves to indicate the nature of the affection. From diabetes it is distinguished by the absence of glucose from the urine, although it is claimed that traces of sugar have been observed. Inosite or muscle sugar has been observed in the urine. There are cases of interstitial nephritis closely resembling polyuria, but if urinalysis is employed with persistence the differentiation may usually soon be made. Interstitial nephritis usually develops at a later period of life, the amount of urine is not as large, and a trace of albumen may be at least occasionally discovered. The further recognition of tube casts and cardio-vascular changes gives certainty to the diagnosis. This affection may supervene upon polyuria.

Prognosis.—Recovery takes place in but a very small percentage of cases, and some which have apparently recovered relapse. The course of any primary trouble or of any complication which may exist, must be considered in estimating the future of the patient. A duration of fifty years was reported by Willis, and most cases free from serious primary disease live many years. I have watched one case for nine years, during which time the general health has been quite good.

Treatment.—Treatment cannot be said to be satisfactory as long as the majority ultimately die, still I have found remedies to possess considerable influence, and this is the testimony of some other observers. Hughes commends *scilla* 2x as having given good results in two cases. My own experience has been best with *strophanthus* which has, unaided by any accessory measures, apparently cured a case which had existed in a boy of fourteen for several years. There was no evidence of a primary lesion, but he came from a highly neurotic family. Eight to fifteen pints of urine were passed in the twenty-four hours. He was thin, dyspeptic, nervous and slept poorly. The urine had a specific gravity of 1002 to 1006. There was no sugar, albumin nor casts. He has now remained in a normal condition for two years. The first decimal dilution of the remedy was given. *Phosphoric acid* has proven of service when there was feeble-

ness of the nervous system and marked phosphaturia or oxaluria; *murex*, when associated with disorders of the female generative organs; *uranium*, when the stomach was irritable and the urine acrid; *chloride of gold*, when associated with many neurasthenic symptoms. *Argentum* has proven curative when there was much weakness and emaciation, frequent micturition, profuse turbid urine, dyspeptic symptoms with fœtid taste.

The remedies having diuretic action should be especially studied, and some hints of value may be secured from those recommended for diabetes. As in other constitutional diseases, a broad view of the case must be taken, as the pathological ramifications are often extensive.

The old school relies upon *valerian* and *opium*, which are given in large doses and which are stated to cure some cases, although statements are most contradictory, especially regarding opium; antipyrin, arsenic, ergot, strychnine and bromides are also commended.

RHEUMATISM.

In different periods of medical history this term has been employed with varying signification. It originally designated that condition of the mucous membrane which we now call catarrh and was first applied to what is now known as rheumatism by M. Baillon in 1642. Rheumatism was long confounded with gout, but was differentiated from the latter by Sydenham, who published the first satisfactory account of its character. It is one of the affections still difficult to define satisfactorily. It is evidently general in character with local manifestations which may develop in any of the tissues of the body, but attacking by preference fibrous structures associated with the articulations and the fibro-serous tissues of the heart. In some instances morbid changes in the tissues are entirely wanting, nothing being discoverable to explain the fatal result. We know nothing positively regarding the real cause, and it is therefore difficult or impossible to invariably separate rheumatism from affections which develop clinical groups of the same general character, which is true of gonorrhœa and various toxæmic affections. In typical acute articular rheumatism differentiation is easy while in its dissociated endocardial development, and some abarticular manifestations, there is nothing in the general symptoms or local changes to make clear the rheumatic nature of the disease.

Definition.—We are in a position to assert no more than that rheumatism is a non-contagious febrile disease characterized by polyarthritis and a tendency to involvement of the fibro-serous elements in the heart, and in typical cases by a great variety of clinical phenomena, due to localization of the disease in various organs and tissues, that in its general course and characteristics it resembles specific infectious diseases, and that there are strong reasons for believing that it is due to the influence of pathogenic micro-organisms.

Rheumatism is most conveniently considered first, in its acute articular form; secondly, in the subacute variety, and, finally, in its chronic manifestations.

ACUTE ARTICULAR RHEUMATISM.

(RHEUMATIC FEVER.)

Etiology.—As the essential cause of rheumatism is unknown we can consider only theories as to its causation, which may be grouped under three heads: (1) That which attributes rheumatism to disordered metabolism with the development of an irritant within the body possessing an affinity for fibrous structures. This irritant is considered by some (Prout and Richardson) as being lactic acid. (2) That which considers disorder of the central nervous system excited by peripheral irritation (cold) as the primary factor, with resulting lesions of trophic or vaso-motor origin, or from disturbed metabolism due to the primary disorder of the nervous system from cold, with accumulation of lactic acid which becomes the immediate exciting cause of the morbid changes. This theory was advanced by J. K. Mitchell and supported by S. Weir Mitchell and others, but while plausible it will not bear thorough investigation. (3) The most popular hypothesis is that which attributes the disease to the action of micro-organisms. Such organisms have not yet been identified, but we are justified by the analogy which exists between rheumatism and many infectious diseases in hopefully expecting that it will ultimately be accomplished.

Maclagan has recently strongly urged the dependence of rheumatism upon a miasm, and compares at length the features of rheumatism with those of malarial infection. He does not, however, consider the specific agent in these affections as one and the same, but thinks them "allied in nature and mode of action."

Concerning certain predisposing and exciting causes we possess considerable information. *Age* exercises a most important influence. Few cases develop before the tenth year. From this time until the fifteenth year the number increases rapidly. The greatest increase takes place during the succeeding decade, *i. e.*, between the fifteenth and twenty-fifth years. During the succeeding ten years, *i. e.*, from the twenty-fifth to the thirty-fifth years, the number is reduced nearly one-half and the same statement is applicable to the succeeding decade. After the latter age there is a rapid disappearance of the disease tendency. The number of cases appearing in young children and infants has been exaggerated by the confounding of septic arthritic troubles, syphilis and infantile scurvy with rheumatism. I have seen three instances of the latter, being called to see a "case of obstinate rheumatism" in each instance. In Besnier's col-

lection of 8631 cases about one case in twenty-nine represented a child. Children then, and those past middle life, possess a considerable degree of immunity. To what the susceptibility of adolescents and young adults is due we cannot fully decide. The most important fact we possess regarding this is that it is the period of greatest functional activity of the very structures involved (articulations and heart), and also the period of greatest general activity, exposure to cold and damp, as well as of mental work and strain.

Sex. Men are rather more frequently attacked, probably due to their greater exposure to exciting causes, especially to cold and damp; the disease is therefore more frequent in certain classes of laborers, in drivers, servants, marketmen, milkmen, etc.; indeed, occupation possesses a most important influence, as a large majority of all cases develop among the poor, laboring, exposed, and deprived.

Heredity exercises an important influence and can be traced in nearly one-third of all cases. In what this predisposition consists we only know that it is but feebly developed before fifteen years of age and rapidly diminishes after middle life. Even if the dependence of the disease upon a micro-organism were established we still have to explain why some are so much more susceptible than others, and also, why the disease prevails in certain families. Especially on account of resemblances to gout may we recognize it as a variety of the arthritic diathesis, but this is indefinite and may prove a predisposing factor only.

The influence of *residence* has been carefully investigated with the result of determining that a life in the fluctuating temperature and dampness of the temperate zone exposes one to the greatest risk of contracting the disease. *Altitude.* Rheumatism is prevalent in some high altitudes. I have observed this upon the high plateaus in the west of the United States. In this region a powerful exciting cause is the chilling of the surface due to the difference in temperature which exists between the exposure to the sun's rays and to the shade, also the wide extremes in temperature which develop between midday and midnight. Low-lying, damp and cold regions, exhibit a decided preponderance in the number of cases developed. *Season.* In this country most cases are admitted to our hospitals during the spring, although Bruce (English) states that "no definite etiological relation can be traced between prevalence of the disease and weather and season."

Cold and Dampness. Of the influences which appear to excite the development of rheumatism none are as important as exposure to cold and dampness. Experience, especially in Arctic regions, indicates that unaided cold is not sufficient for its production. Dampness, therefore, appears to be more important in its influence than cold, the effect of which, however, is greatly increased by cold. Exposure to draughts of

cold air while heated, or wetting with a cold rain while in this condition, are causes of many cases.

House prevalence has been observed, but in many instances is attributable to heredity or dampness or bad sanitary condition of the premises. *Epidemic prevalence* has often been noted, as well as epidemical peculiarities of onset, variations in intensity, progress, complications, fatality, etc. One of the most notable variations from year to year is the great difference in the percentage of cases in which cardiac complications occur.

Overexertion, which temporarily impairs the nutrition of the articular structures, is an exciting cause in the predisposed, and is often conjoined in its action with chilling of the surface of the body. Direct injury to a joint tends in this class of persons to localized rheumatic inflammation, but undoubtedly many cases supposed to be of this character are of the nature of rheumatoid arthritis. This should be suspected if the patient has reached middle life without a history of previous rheumatism, also if the lesion is confined to one articulation and tends to chronicity.

Rheumatic subjects sometimes refer their attacks to disorder of the digestive organs. Attacks and relapses are clearly excited by indulgences in excessive quantities of food, especially if of an improper character.

Depressing emotions, suppression of habitual discharges, previously developed disease, notably scarlet fever and influenza, the puerperal state and various affections of the pelvic organs, appear to influence the development of the disease in some instances.

Pathology and Morbid Anatomy.—The most important morbid changes involve the joints, heart and blood. Occasional lesions are found in other tissues, especially the lungs. The parts attacked are those associated with active movement.

Changes in the Joints. There are no pathological alterations occurring even in the joints to individualize the nature of the disease, although often suggestive. All of the tissues entering into the formation of the articulation and immediately related to it are involved. In consideration of the activity, and often the duration of symptoms related to the joints, the degree of pathological change discoverable is exceedingly slight. The tissues about the articulation are in a state of inflammatory œdema, which is the principal cause of the swelling. Ecchymoses are found in the intermuscular and subcutaneous connective tissues. The tendon sheaths are injected and contain fluid. The synovial tissue is highly vascular and much thickened, and the distended vessels stand out boldly. The joint cavity is filled by a small amount of fluid, which may have an acid reaction. The distended vessels and the synovial membrane may rupture with slight hæmorrhage into the joint. The fluid within and without the joints contains some pus corpuscles, but it is questionable whether free suppuratiou ever occurs in uncomplicated artic-

ular rheumatism. Cases of arthritis having this feature are usually of pyæmic origin. Cases of articular rheumatism occurring in persons who have shown the presence of a rheumatico-gouty diathesis may develop permanent lesions. In aggravated cases, especially those much protracted, the cartilages may undergo some degree of erosion with loss of their smooth surface. The microscope reveals division of the cartilage cells by segmentation, the cells arranging themselves in rows perpendicular to the surface. There is fissuring of the matrix in the same direction, which imparts a soft, velvety appearance to the surface. Portions of the periosteum, also of the bone-marrow in the articular ends of the bones, exhibit hyperæmia and hyperplasia. In how far these grave structural changes may be due to rheumatoid arthritis rather than to articular rheumatism is a question of interest.

Small nodules of fibroid tissue may be found in the fascia, attached to tendon sheaths, and over the articular extremities of the bones, especially in young subjects. They have a translucent appearance and are composed of rapidly developing connective tissue cells.

The *blood* contains an increased quantity of fibrin, the product of the rapid waste of nitrogenous tissue; one per cent. is not unusual, being an increase of four- or five-fold. In consequence of this, coagula may form in the heart and arteries. The fibrin may also be whipped out of the blood by the altered valve-leaflets of the heart. The blood liquor preserves its alkalinity, but there is a marked reduction in the number of red corpuscles. Examinations for the discovery of morbid products in the blood which may possess some influence, have been entirely negative, neither lactic acid, uric acid nor urea being found in excess during the course of an acute attack. Alterations in the blood and bloodvessel walls, with escape of coloring matter and of corpuscles, are rarely observed; equally rare are blood changes resembling those of the infectious fevers, which occur especially in association with cerebral rheumatism and hyperpyrexia; but we may well doubt the purity of the process in these cases. It is probable that mixed infections occur at times, giving rise to these atypical conditions. The presence in the blood of bacteria of various kinds has been described, but nothing yet has been established in this line.

The occasional lesions are in most instances the direct cause of a fatal result, the most important of these being those which develop within the chest cavity, viz., the various forms of inflammation of the heart, pneumonia, pleurisy and bronchitis; laryngitis, meningitis, etc., occur, but are less important. In rare instances the peritoneum, kidneys and testicles may be involved. Inflammation of the tonsils is a common result of the action of the rheumatic poison.

Clinical Course.—Most typical cases of acute articular rheumatism begin abruptly, well-defined symptoms being preceded by erratic pains

especially in the joints, general aching, loss of appetite and a sense of impending illness. The onset is rarely by decided chill, but rather a simple chilliness followed by rapid rise of temperature, pain in several joints and free sweating, the cutaneous secretion rapidly developing a peculiar sour odor.

The articulations most frequently attacked are the knees, ankles, elbows and wrists. The joints of the lower extremities are most frequently involved; the shoulders and hip-joints less frequently. Of the small joints the metacarpo-phalangeal are most often attacked. The sterno-clavicular articulations and the vertebral are among the rare points of attack. The small joints of the feet are rarely involved. The development of the inflammation in the several joints is by successive involvement, a simultaneous attack of several being rare. Most frequently the knees are first involved, followed by the wrists or elbows and later the ankles. The development is usually symmetrical, *i. e.*., both knees or both wrists are attacked at the same time, occasionally, however, one knee and the opposite elbow or wrist may be involved, and later the second knee and elbow. This shifting erratic character of development of the lesions is quite peculiar to rheumatism and may result in the involvement of the same joint more than once during the course of a single attack.

The *local symptoms* are pain, tenderness, swelling, heat and redness. Local increase of heat is usually marked. Joints but scantily covered with soft parts, as the ankles, manifest the most pronounced local symptoms. The œdema causes much puffiness. This element is absent in some cases, even of a very active character. The degree of redness and want of characteristic symptoms of rheumatism may lead to a suspicion of erysipelas when one joint only is involved. The nodules described may be felt and are sometimes seen, and may be located in various portions of the body, even in the scalp. They are not sensitive to touch.

Febrile Symptoms. The fever is of irregular type, usually fluctuating in intensity with the number of joints affected and the intensity of the inflammatory process. It is also much influenced by the sweating, which is coincident with the periods of remission in fever. In mild cases the temperature reaches 101° or 102° F., while in severe attacks the thermometer often registers 103° to 104° F. It is rarely higher. Fever may precede the joint involvement, and in such cases it may be ultimately discovered that inflammation of the heart or other unusual manifestation of the disease has developed prior to that in the joints. All cases cannot be explained in this manner, however.

The urine is scanty, of high specific gravity, high colored, very acid, concentrated, and deposits amorphous urates freely. Uric acid crystals are common. In some aggravated cases there may be a trace of albumin in the urine. The chlorides are much diminished.

There is copious sweating, and unless the surface is regularly and properly cleansed, it quickly assumes a strongly acid and offensive character. When persistent, the secretion becomes neutral or alkaline in reaction. Sweating is not a critical phenomenon in rheumatism, but a prominent symptom of the disease, probably dependent upon the irritating influence of lactic acid. Sudamina or miliary eruptions result from the sweating, and are without significance.

Digestive Organs. The appetite is poor or absent, the tongue heavily coated with thick whitish or grayish fur, and there are much thirst and constipation. Less frequently there may be nausea and vomiting.

Symptoms dependent upon blood changes develop rapidly, for in no febrile affection does anæmia progress with greater pace.

Nervous System. Most patients are anxious and have great fear of the pain. There is usually much loss of sleep, the result of the severe pain. In unusual cases there may be delirium with talking of business, or it may assume a more active form especially in those who have been addicted to the use of alcoholics, or in association with pericarditis. Meningitis may occur and does not differ materially in the symptoms from the disease when not associated with rheumatism. Grave cerebral symptoms are due to inflammation of the heart, particularly pericarditis, and to hyperpyrexia.

The position of the patient is upon the back. The weight of the clothing even is illy borne and there is fear of the slightest movement. The limbs are usually partially flexed, the arms pronated and the fingers extended.

Respiration is but moderately increased unless there is inflammatory involvement of some of the chest organs. Most patients cough a little and a few dry râles may be heard.

Involvement of the heart may take place at any period of the disease, but rarely after the first week. While not usually imperilling life the heart is permanently impaired in a large percentage of cases.

The duration of the acute symptoms without medicine but with good care, is from ten to twenty days, but may be extended much longer. Under modern treatment most cases are promptly controlled, the pain usually subsiding within two or three days; but every item relating to care and treatment should remain in force for at least ten days or two weeks, for notwithstanding the patient may be relieved from pain there is liability to a fresh outbreak upon the slightest provocation.

The disease may be repeatedly incited to activity by too early sitting up or improper eating and thus indefinitely prolonged. This is especially true of cases treated in recent days, *i. e.*, since our ability to quickly control the acute symptoms. One or more relapses may occur after the attack has apparently run its full course to a conclusion, and often without apparent reason. In this manner the disease may be

greatly prolonged or finally assume the chronic form. The relapse may be as severe as the primary attack and marked by complications. Recovery is often tedious after attacks of considerable intensity; debility, stiffness, pain, anæmia, etc., disappearing slowly.

The danger to life from acute articular rheumatism is not very great; a few die from hyperpyrexia with associated cerebral symptoms and from intense cardiac inflammation, but a very much larger number pass a life of discomfort as a result of the chronic heart lesion which supervenes. Indefinite prolongation may result from the development of the disease upon a gouty or scrofulous soil, which is more common when one articulation only is involved.

Defervescence is usually gradual. The general course of rheumatism is much influenced by a variety of features spoken of as complications. The minority only manifest a typical character. A few are of slight intensity and short duration (mild cases); others are of mild intensity but much prolonged (subacute cases); others develop serious cerebral symptoms (cerebral rheumatism). Inflammations of the heart, lungs and pleura are the most frequent complications; the development of meningitis, nephritis and other affections may stamp the disease with unusual features. Some of these require special consideration.

Cardiac Lesions. The tendency of rheumatism to involve the heart constitutes the gravest feature of the disease. It is difficult to determine the percentage of cases developing this feature, but according to old school authorities it is not less than 50 per cent. for all cases. Most authors give 30 per cent. for the acute variety. The especial sources of error in estimating the frequency of cardiac involvement are first, the overlooking of many cases during the course of the attack of acute rheumatism and the existence of some which cannot be diagnosticated at that time; and secondly, basing a diagnosis upon the presence of an apex murmur, which we now know may be caused by other conditions than endocarditis, and which may disappear (see mitral disease, page 67).

The cardiac inflammation may develop in any form of rheumatism, partaking in its intensity of that of the general disease, *e. g.*, in the acute form, the inflammation of the heart or its membranes is acute and may be ulcerative, while in chronic rheumatism the development is insidious and may not attract attention until changes in the organ with serious impairment of function have resulted. That associated with subacute rheumatism holds a middle position.

The most important factor in determining the occurrence of inflammation of the heart is the age of the patient. The percentage of cases in which the organ is involved diminishes with each decade of life. Young children rarely escape if their attack is acute. After forty it is a rare complication. Of hardly less importance is the intensity of the

attack. Sex possesses an influence, as more females are attacked under fifteen years of age. Improper treatment or a want of early treatment are influential. In the great majority of instances, the attack upon the heart may be discovered during the first few days of illness, often upon the first visit; certainly within the first week. But few develop after this time. When we consider that the diagnosis is based mainly upon an endocardial murmur and that before this can appear certain pathological changes must have taken place in the valves of the heart, it is easy to believe that the heart changes are often among the first to develop, or that they may often actually precede the inflammation in the joints. This is demonstrated by our ability to sometimes detect the developing bruit days before the appearance of joint-pains. Endocardial changes (valvular disease) may develop gradually in association with slight chronic rheumatism, or may precede the chronic rheumatic developments for months.

Of the various forms of cardiac inflammation the most frequent is *endocarditis*, which involves the mitral valve in the majority of cases. The ulcerative form is unusual and more apt to supervene upon old lesions left from a previous attack of rheumatism. In a few cases the valvular changes progress rapidly with development of a high degree of regurgitation, acute dilatation, and a fatal issue within a few weeks or months. In the majority it does not compromise life and may be easily overlooked owing to the slight character of the lesions and its attending symptoms, but even these slight lesions prove the beginning of chronic sclerotic changes which warp and retract the valves with ever increasing obstruction of the circulation. To determine whether an endocardial murmur is recent and therefore indicative of the presence of an active inflammatory lesion, one must auscultate the heart daily, for in recent cases the murmur undergoes changes in intensity and diffusion from day to day.

Pericarditis may be associated with endocarditis or myocarditis, or exist uncomplicated. We meet all forms, viz., fibrinous, sero-fibrinous, purulent and hæmorrhagic. Its physical signs are usually sufficiently well developed to permit of a ready diagnosis, but there are notable exceptions to this, which are considered in the article devoted to this subject; also the symptoms, some of which, for instance the peculiar delirium sometimes met, are peculiar and interesting.

Pericarditis usually develops at a later period than endocarditis, often in the second week or still later.

Myocarditis. The heart muscle may undergo change independently of associated inflammation of the endo- or pericardium, but this is rare. This complication standing alone is so unusual that I cite the following: A clergyman who has been under my care for some time, developed in connection with a rheumatic attack of slight severity, dyspnœa, great rapidity and feebleness of the heart's action, with signs of dilatation

especially of the left ventricle, and slight cyanosis especially in the extremities. Persistent examinations have failed to reveal murmurs or friction sounds at any time. The heart has gradually improved after months of rest and careful treatment, but is still feeble.

In cases of great intensity all the structure of the organ may be involved. The frequency of occurrence of cardiac complications demands that *a daily investigation of the condition of the heart should be made in all cases of rheumatism* whether they be mild or severe, and that every means be employed to limit lesions, the development of which we have not been able to prevent, though notwithstanding the exercise of every care a large percentage will bequeath permanent structural disability to the organ.

Complications involving the Nervous System. These are quite numerous. *Delirium* is unusual, but of most serious import. Of late many cases have been attributed to the use of the salicylates. Alcoholic subjects are quite prone to develop delirium, and it may assume the form of typical delirium tremens. Some are of the nature of cerebral intoxication and similar to those taking place in infectious diseases. Others are associated with meningitis, pericarditis or hyperpyrexia. *Convulsions* occur in but a very small number of cases and may be followed by *coma*, which is a more frequent symptom, and may appear even during convalescence. Coma may or may not be preceded by delirium. Some are due to uræmia and others are not explained. *Cerebral embolism*, accompanied with hemiplegia and aphasia, occurs rarely. *Insanity* has developed in association with acute rheumatism, and Savage has repeatedly found insanity disappearing during the progress of acute rheumatism. The relationship existing between rheumatism and *chorea* has been discussed in the article upon the latter. The relation is a very decided one, the muscular twitchings of chorea sometimes developing with the acute rheumatic attack or following upon it. *Meningitis* is very rare.

Hyperpyrexia is a rare but most serious development. It may appear at any time, but particularly during the period of greatest activity of the disease. It has been observed at a time when the patient was supposed to be convalescing. The height of the temperature may be as great as 107° to 110° F., although only a few of these very high registrations have been recorded. 106° to 107° F. is more common. A temperature of 104.5° or 105° F. may be attended in some instances by as serious symptoms as much higher temperatures in other individuals. Hyperpyrexia may be accompanied by delirium, although a fatal issue may occur without cerebral symptoms of any sort. The onset of high temperature is often indicated by the general evidences of increased fever, by delirium, by lessening or disappearance of the joint symptoms and of the profuse sweating; the patient is somewhat excited and the cheeks may be flushed.

The various conditions involving the nervous system are grouped together by some authors and called "cerebral rheumatism."

Association of rheumatism with skin lesions. Various rashes have been observed, especially a scarlatinoid efflorescence, but more remarkable is the development of rheumatism (or an allied condition) with erythema or urticaria. Either the rheumatism or the skin changes may be primary. It may appear also in association with purpura, ulcerative endocarditis, thrombosis, etc. Scarlatina and acute rheumatism may be associated, either appearing primarily. I have observed rheumatism as more frequently supervening upon scarlatina.

Respiratory Complications. A large proportion of the deaths from acute rheumatism are due to involvement of the respiratory apparatus. It is not uncommon for the pleura to be attacked by extension from the heart, and the lung by extension from the pleura. Any combination of inflammatory processes involving the heart, the endo- and pericardium, the pleura and the lungs, may be observed. The frequency of involvement of the lungs is rated at from 5 to 15 per cent. No period of the disease is exempt from the appearance of respiratory complications, but they mostly develop during the height of severe attacks. The lungs do not appear to be affected prior to the joints as frequently as the heart. Aside from pneumonia and pleurisy, intense hyperæmia of the lungs, acute bronchitis and laryngitis, are all of occasional occurrence.

Diagnosis.—The diagnosis of acute articular rheumatism is not ordinarily attended with difficulty. In the early stage it may resemble certain infectious diseases, but with the advent of joint changes these can be generally excluded. When sore throat is a prominent early symptom it may suggest catarrhal pharyngitis or simple tonsillitis, but in this instance, also, the joint involvement soon makes clear the nature of the case. In rheumatism presenting difficulty in diagnosis during the early stage, the histories of the individual and of the case are important, often revealing a personal or family tendency to rheumatism.

With full development of the disease the uncertainty increases, as there are several forms of arthritis possessing marked similarity to rheumatism, viz., secondary multiple arthritis, septic arthritis, acute arthritis of infants, rheumatoid arthritis, gout, acute synovitis, traumatic arthritis and acute osteo-myelitis.

Secondary multiple arthritis embraces the several forms of inflammation of joints developing during, or as a sequence of, various infectious diseases, especially gonorrhœa, scarlatina and cerebral spinal fever. The gonorrhœal form is most common. Its nature is clear if there is a urethral discharge, but as this form of arthritis may develop in connection with a very slight chronic discharge, this important feature of the case may be overlooked. Occasionally several joints are involved. The

lesions are marked by persistency, *i. e.*, they are not erratic as in acute rheumatism. As some cases of this form of arthritis are attended by cardiac and cerebral complications it is questionable whether they may not be really rheumatic in nature. When the lesion is confined to one joint the diagnosis is easy. In gonorrhœal arthritis the fever is slight compared with the gravity of the joint affection, suppuration may take place, and there may be a catarrhal conjunctivitis.

Septic and *infantile arthritis* are also of pyæmic origin. Purulency is the most important feature of each, and there is usually evidence of some primary focus from which infection may have taken place. There may be rigors, sweating is intermitting, and there is sometimes evidence of visceral involvement.

Rheumatoid arthritis not infrequently involves several joints, develops with considerable acuteness and resembles acute articular rheumatism closely, but there is little fever compared with the extent of the lesions, deformity often develops rapidly, there may be distortion of some of the finger joints and a family history of the disease. There is no tendency of the lesions to shift, nor does the patient sweat or often develop cardiac complications.

Gout appears in persons in or past middle life; there is a history of previous attacks. The development is usually sudden, perhaps during the night, the patient having been well the previous day, the swelling rapidly appearing, atttended with considerable redness, and is usually followed by relief from pain. The examination of the blood serum for uric acid may be instituted in cases which are in doubt.

Acute synovitis is nearly always limited to a single articulation, follows traumatism or occurs in scrofulous or diathetic individuals.

Scurvy in children is sometimes mistaken for acute or subacute rheumatism. In these cases there is great pain on movement, but rarely swelling of the joints or evidence of localization of the pain to the immediate region of the joints. They are promptly improved by anti-scorbutic diet.

Acute osteo-myelitis may be multiple and resemble rheumatism closely. The severity of the general and local symptoms and the fact that the latter involve the epiphyses, furnish characteristics which should prevent error. The location of the tenderness in the early stage, which is not at the centre of the joint, I have found important.

Prognosis.—General statistics indicate that death occurs in about 3 or 4 per cent. The mortality must be much less in private practice, as my losses during twenty-five years do not number over three or four cases. One of these died of heart complication, a second of cerebral embolism, a third of pleuro-pneumonia supervening upon pericarditis, and the fourth, I am not clear concerning, having no records of the case, which occurred many years since. The causes of death are within the

chest in nearly all cases. While danger from the acute attack of rheumatism is slight, that from the supervention of chronic heart disease is very considerable. The ultimate mortality attributable to rheumatism is therefore large. Although the immediate danger is not great, a guarded prognosis is wise on account of the unreliability of rheumatism, *i. e.*, as to its course, and the occurrence of complications, and as death occurs from these complications we can never tell with any certainty those cases which are likely to develop them.

Subjects of impaired nutrition, those who are enfeebled by excessive mental or physical fatigue, especially ill-nourished young girls who are poorly fed, are at hard labor and, perhaps, exposed to cold and damp, are particularly liable to the development of complications and to protraction of the disease. The risk of complicating lesions is greater the greater the intensity of the joint inflammation. The probability of cardiac involvement is much greater in the young, it seldom occurring after the age of forty years. The risk of inflammation of the heart arising diminishes rapidly after the fourth to the sixth days of the attack. While the frequency of cardiac complication is so great in the young, their general symptoms are often of but slight intensity. Hyperpyrexia is a grave condition, prostration rapidly supervening, with feeble pulse, delirium or coma.

Treatment.—Much attention must be bestowed upon the general care of the patient. In ordinary practice this is much neglected. It is particularly important that it should be instituted at the earliest hour possible, that the danger of serious complications, the most important of which usually develop during the early days of the attack, may be diminished. Perfect rest in bed is essential. A quiet, well-ventilated room should be selected, but one which is free from draughts of air and in which a proper temperature can be preserved. The bed should be firm and narrow for convenience in turning and lifting the patient. Blankets only should be employed for bed-clothing, and these should not be burdensome by reason of their weight. They should be changed at suitable intervals. Whether involved in the inflammation or not the knees, ankles, feet, elbows and hands should be washed with warm water and soap and enveloped in layers of absorbent cotton which are to be held in position by flannel bandages. This application should be changed every two or three days and the surface cleansed with warm water and soap. This step should be carefully performed in order to avoid chill. If skilfully employed this method is at least as successful as that by means of silicate of soda or plaster of Paris bandages, and very much more agreeable to the patient. The sick person's gown should also be of flannel and open upon the arms as well as down the front. The entire surface of the body should be deftly cleansed at sufficiently frequent periods to keep the skin in good condition. There is no necessity for

the rheumatic patient to lie in filth, as we so frequently observe. A proper urinal and bed-pan are essential. The painful parts should be carefully adjusted upon pillows, the latter being enveloped in small blankets, which should be changed as soon as moist. A good deal of care should be exercised to soak up excessive sweat in order to avoid too frequent changes in bed-clothing. This can be done with small portions of a blanket, a number of which should be tucked about the patient. The bowels often require the aid of some alkaline mineral water or of glycerin suppositories or enemas, as they should under no circumstances be allowed to remain unmoved for several days. Water should be given freely and is generally demanded. It is therapeutically valuable. The stomach should not be chilled with large draughts of ice-water. Aerated water is admissible. Water rendered acid by lemon or lime juice is often acceptable and not objectionable. Alcoholics are not called for until there is marked debility, feeble heart, anæmia, etc. During the period of active inflammation the food should be simple in character and consist largely of milk in some form, viz., plain, shaken, mixed with aerated waters, particularly Vichy or seltzer, koumiss, curds and whey, buttermilk, matzoon, cream diluted with hot water, etc. A very little of some simple solid food, well masticated, is rather an advantage, I think, cleansing the mouth and exciting the salivary secretion; it also often satisfies the cravings of the patient. After the inflammatory symptoms have subsided a more generous diet is demanded, but the free use of meat had better be avoided.

Medicinal Agents. If seen in the early stage a great deal may often be accomplished by the employment of *aconite*. This is particularly true of young subjects who are made restless and excitable by the pain and who appear in much fear of the suffering, and if old enough, apprehensive regarding the result. Aconite often affords prompt and remarkable relief even when given in exceedingly small doses. Its use is sometimes followed by a gentle moisture without the acid odor, convalescence dating from that time. More often while some degree of relief is obtained the disease marches onward in its typical course and another medicine must be selected, which is most frequently *bryonia*, a remedy which is better able to cope with the established lesion. It matters little whether the joints are much or little swollen, red or pale, or whether the inflammation involves also the muscles of the trunk, this remedy relieves if the general symptoms for it are present, especially aggravation of pains from the slightest motion, a tense rapid pulse, marked thirst, irritable stomach, a little nausea and giddiness if the patient is elevated, constipation, etc. I think bryonia acts better when there is much periarticular œdema. This remedy is also of first importance for pericarditic, pleuritic and pneumonic complications. Whether it possesses the same degree of influence over endocarditis is questionable, but this is more difficult to decide. I find the first to the third decimal dilutions satisfactory.

Rhus toxicodendron is a royal remedy prescribed with great satisfaction if well understood. It is most useful when there is great pain and restlessness, forcing the patient to move notwithstanding the pain which it excites. The pain is often of a general character, *i. e.*, involving more of the limbs than the joints. There may be much backache. The joints are slightly and sometimes not at all swollen, although swelling is not a contra-indication if this remedy is otherwise suitable. Rhus is also called for in protracted cases with a dry, red tongue and the development of the typhoid state.

Ferrum phosphoricum is as valuable as aconite in the early stage if there is an absence of the peculiar irritability of the aconite patient. It possesses much greater control over the fully-developed lesion. I am impressed that it has considerable influence over the endocarditis, especially in young subjects, and I have observed admirable results in some cases of a rather subacute character if the parts were exceedingly sensitive to touch and continuously painful "as if mashed."

Pulsatilla gives the best results when the swelling has been unattended with much redness or pain and when the knees are the parts especially involved. It also suits some cases with erratic lesions, particularly if developed in girls who have scanty or delayed menses and other indications for pulsatilla. Amelioration from cold is a symptom of value but is rarely met.

If the joint inflammation is persistent in a single joint or in several, if the pains are much aggravated at night and the patient sweats freely, if the tongue is heavily coated and exhibits imprints of the teeth, or the bowels are catarrhal, *mercurius* should be considered.

Colchicum, which has been so much employed for gout, has also been used by homœopathists for rheumatism, but upon rare occasions only. Some eight years ago I began the use of *colchicine* for typical acute articular rheumatism with the result of discovering that it is as nearly a specific for articular rheumatism as quinine is for malarial intermittent fever. A sufficiently large number of cases have now been treated by me and a number of colleagues to thoroughly demonstrate its value. A solution of the strength of one grain of Merck's colchicine to one ounce of alcohol is a very satisfactory strength for dispensing purposes. Like many other medicines colchicine gives the most satisfactory result when given almost to the point of producing its physiological action, the indication of which is the development of some disturbance of the gastro-intestinal tract (nausea, colic, loose movements). It is desirable to avoid this result, which is easily done if the remedy be discontinued upon the appearance in the slightest degree of symptoms of this character, and resumed in one-half to two-thirds of the previous dose after complete disappearance of the annoying symptoms. If skilfully employed the pain and swelling quickly diminish and the most active cases are usually controlled within

a few days. A little experience with this remedy is necessary before one learns to administer it to the greatest advantage. It is necessary to continue the general care of the patient and the medicine for at least ten days or symptoms may return. This statement applies equally to any method of treatment. Of the preparation of colchicine suggested doses of three to five drops, repeated every two to four hours, according to the age of the patient, intensity of the pain, etc., is the method I employ.

The use of these remedies in association with proper general care proves sufficiently satisfactory to enable us to dispense with the use of *morphia*, phenacetin and other drugs for the control of pain, although in refractory cases we may sometimes be glad to avail ourselves of their aid for a short time. The action of colchicine, in particular, is so prompt and effective as often to suggest that an opiate has been given, were one unacquainted with the remedy employed.

Of medicines less frequently prescribed *arnica, belladonna, caulophyllum, cimicifuga, chamomilla, cinchona, ledum, nux vomica, phytolacca, sanguinaria* and *sulphur* are most prominent.

Cimicifuga and *phytolacca* are indicated by involvement of the muscles of the trunk. The former is suited to rheumatic attacks complicated by chorea. There is little fever. The pains are shifting. *Caulophyllum* when the small joints are attacked. *Arnica* if the parts feel bruised, are very sensitive to touch and redness is slight or absent. *Belladonna* for rosy, red, puffy swelling, with throbbing pains and general belladonna symptoms. *Cinchona* when the attack follows upon hæmorrhages (metrorrhagia) or conditions which have debilitated the patient rapidly. There is sensitiveness to light touch. *Ledum* for some persistent attacks involving the lower extremities especially. There is little swelling, no redness. *Sulphur* is valuable at some period of most chronic cases, especially if there are symptoms of portal congestion. A large number of its well-known general symptoms are attendant upon chronic rheumatism.

Salicylic acid and *salicylate of sodium* are extensively employed. The former was introduced in 1875. The latter is used largely on account of its greater solubility. These remedies have unquestionably worked a revolution in the treatment of acute rheumatism as conducted by the old school, and aside from heart depression and some cases of delirium which have been attributed to their excesssive use, have produced no unpleasant symptoms. Pain is very rapidly diminished, and with proper precautions, the improvement gained is held and the patient makes a rapid recovery. I am satisfied, however, that better results are obtained by means of the treatment previously sketched. Colchicine has proven more effective in my hands than the salicylates; the dose is exceedingly small, and with a little experience one can invariably avoid the production of any unpleasant symptoms.

Endocarditis, pericarditis, pneumonia and other complications of rheumatism do not often require special treatment, as those remedies and general measures which best control the rheumatism prove most efficient for its complications. Indications for the special treatment of these affections will be found in the several articles devoted to their consideration.

SUBACUTE RHEUMATISM.

This term, as employed by different authors, embraces a variety of atypical cases, some of which are protracted, but all are characterized by an absence of acute development of the local or general symptoms. The term should be abolished, as in its present use it leads to confusion. These cases are, in general, of mild onset, the number of joints attacked may be few—often but a single one. The suffering is moderate and the sweating slight. The inflammation exhibits the characteristic tendency to shift from one point to another, and the heart is attacked in a smaller number of cases than in the acute variety. The temperature is but slightly elevated, the urinary changes are not pronounced, the patient's sufferings are not intense, and in mild cases recovery takes place within a week, while in others this rheumatism of slight intensity is protracted for many weeks by the successive involvement of different joints, some being repeatedly attacked. It is to this group of protracted cases of slight intensity that I would limit the term subacute. The consequences are of the same nature as those following upon acute rheumatism, but less frequently developed. Subacute rheumatism is more common in persons who have had repeated attacks of the acute variety, it is therefore more frequent in those who have passed early life.

CHRONIC ARTICULAR RHEUMATISM.

This term is applied to rheumatic inflammation of the joints which develops slowly and is very persistent. Undoubtedly many affections of this general character for which the rheumatic element is not responsible are included under this head.

Etiology.—True chronic rheumatism is the same in nature as the more acute form; the susceptibility to this disease on the part of the patient not being sufficient to lead to the development of a high degree of inflammation. This is in part due to the late period of life in which it usually develops, *i. e.* after forty years of age. It may be a sequence of the acute or subacute forms, which is the origin of most cases occurring in young persons. As in the acute form, heredity, occupation, residence, cold and damp exercise a decided influence. It may follow upon gonorrhœa. Women are more often attacked.

Morbid Anatomy.—The changes are variable even in cases of long standing. They are often slight. In others, contractions of tendons and aponeuroses with deformity of the joint and considerable immobility may

result. There may be thickening of the synovial membranes and fimbriæ and adhesions within the joint cavity. The periarticular structures may be œdematous, but particularly during subacute aggravations. Degenerative alterations in the cartilages may take place, but these grave structural changes are not as frequent as in rheumatoid arthritis. Jaccoud described a peculiar deflection of the fingers to the ulnar side with alternate flexion and extension of the successive phalanges of the fingers. The amount of fluid in the joint is small. There is often little or no external appearance of a joint lesion.

Symptoms.—Pain is the most important symptom and is excited by movement or pressure. The amount of spontaneous pain is not usually great. The joints are often swollen and there may be some redness. The joints most frequently affected are the same as in the acute form. The small joints of the hands and feet are less frequently attacked. There is often creaking of the affected articulations and a good deal of stiffness, which may increase to immobility.

The general symptoms are not prominent. There is no fever, and complications especially those affecting the heart are rare. Exacerbations may be excited by a variety of causes, especially cold and overexercise, and with these there may be some rise in temperature.

The disease is indefinitely prolonged, often for many months or years.

Complications are few, chronic endocarditis being the most serious. The consequences are deformity and ankylosis of joints, and muscular atrophy, which sometimes appears in excess of what can be accounted for by the disease.

Diagnosis.—A consideration of the history, both family and personal, the age of the patient, location of the lesions, their shifting tendency, especially during subacute exacerbations, are all of importance in arriving at a diagnosis. The greatest resemblance is to rheumatoid arthritis, from which it may be impossible to distinguish it without the aid of time.

Prognosis.—Chronic articular rheumatism is a very obstinate affection and often defies treatment, but if the patient is financially able to secure the advantage of rest, climate and proper treatment, a favorable result may be secured if permanent structural changes have not developed.

Treatment.—Many cases persist for the lack of proper treatment. This is largely for the reason that the patient is able to keep about most or all of the time, and constantly hopes to be better without loss of time from business, or the trouble or expense of thorough treatment. The character of the diet is of importance. It should be most nutritious and sufficiently easy of digestion to permit the use of large quantities. Most patients bear this well and improve. Nutritional disturbances should be

carefully considered. If lithæmia exists, it may be necessary to avoid red meats or the free use of starch and sugar. The latter articles are, as a rule, objectionable in chronic rheumatism. Milk in any form may be used plentifully. Water should be taken in quantities sufficient to keep the amount of urine up to the physiological standard. Frequent warm baths, or better, a season at a thermal spring, such as Glenwood, Colorado, is of great benefit. The particular composition of the water is of less importance than the character of the climate in which the spring is located. Turkish baths, if judiciously employed, often prove useful. Dry heat applied to the affected joints may be tried. Massage accompanied with inunctions of oils, if skilfully performed, are of first importance in the line of local treatment. Galvanism of the affected joints favors absorption of exudate and lessens pain. General faradization stimulates nutrition. In obstinate cases a "rest cure" with the aid of the several measures enumerated has given good results. Change of climate is a valuable aid. For winter a warm equable region should be selected, and a moderately high altitude, paying proper regard to the rapidly changing diurnal temperature, good results being often defeated by disregard of this matter. Usually a residence upon the high interior plateaus is preferable to one near the seashore. If the patient must remain at home, a dry bright house should be selected with good sanitary surroundings.

A much broader range of medicines is required in the management of chronic rheumatism than in the acute form, due to the long duration of the disease and its frequent perpetuation by diathetic conditions, accompanied by more or less disorder of various organs. Those recommended for the acute form are useful for the periods of subacute aggravation, and several of them may be indicated and perform excellent service in the control of the chronic development, particularly *bryonia, rhus toxicodendron, colchicine, ledum,* and *pulsatilla.* In considering the value of symptoms as indications for medicines in chronic rheumatism it will be found that the general are of much more value than the local symptoms, but it would require too much space to enumerate many such groups. *Rhus toxicodendron* should be first considered when stiffness is the most prominent symptom, when the joints are little swollen, the changes involving the sheaths of the tendons and the aponeuroses. The aggravation from bad weather, and from rest and relief from gradual motion, are prominent indications. *Bryonia* may help if the joints are puffy, the seat of sticking pains which are aggravated by motion. *Colchicum,* for cases with a gouty ancestry, or when the small joints are involved, the pains are deep-seated and of a tearing character. *Pulsatilla* for subacute or chronic inflammation of the knees or ankles. The joints are puffy, and there is an evening or night aggravation. Women with menstrual disorders are most susceptible to the action of this remedy.

Lycopodium is applicable to elderly lithæmic persons with flatulent dyspepsia and constipation, and *nux vomica* to the same class. With the latter there are complaints of deadness in the affected parts. *Calcarea carbonica* is a remedy intimately related to general tissue nutrition, which performs good service in some cases of chronic rheumatism, especially when occurring in the young. There is nothing of special note in the local conditions. The subjects are fat, flabby persons troubled with local sweats, whose pains are much aggravated by weather changes, and if the subject is a woman there may be profuse menstruation. Sulphur is also prescribed upon general characteristics. *Phytolacca* and *cimicifuga* have been useful for cases marked with involvement of the muscles of the trunk. *Ledum* helps some cases of obstinate rheumatism, especially of the lower extremities. There may be a cold feeling in the affected parts. *Dulcamara* is sometimes successful in the control of rheumatism owing to long exposure to cold and damp, such as frequently results from certain kinds of employment.

If the patient is syphilitic *kali hyd.*, *mercurius*, *hepar* and *aurum muriaticum* should be considered.

Kali hyd., *kali bichr.*, *mezereum*, *phytolacca* are all recommended for periosteal rheumatism which, interpreted, means rheumatism with little swelling.

I have found *guaiacum* useful in some cases occurring in persons subject to tonsillitis.

Benzoic acid or *benzoate of ammonium* is often useful; the best indication being the strong odor of the urine.

GOUT.

Definition.—Gout is a general disorder of nutrition characterized by an excessive amount of uric acid in the system, the influence of which is manifested in (1) "regular gout" and arthritis, especially of the smaller joints (great toe) and associated with a deposit of urate of sodium in the tissues; (2) "irregular gout," represented by functional disorder or morbid changes in various tissues and organs; (3) the evidence of a gouty diathesis independently of known morbid changes.

History.—Gout is an affection of most ancient lineage. We are told in Holy Writ that, nine hundred years before Christ, Asa, King of Jerusalem, "in the time of his old age he was diseased in his feet." Its great antiquity invests gout with a peculiar interest, admirable descriptions appearing in the writings of the physicians of the earliest period of the Christian era.

The term gout (gutta) was applied by Radulphus, late in the thirteenth century, and was based upon the idea of a humor being deposited in the affected joint, drop by drop. Gout has attacked the great in the world's history, especially in certain countries, notably England, a large

percentage of her eminent statesmen having suffered either as the result of their own imprudence in eating and drinking, or as the result of heredity. Great increase in any country is proportioned to the growth and crowding of the population into centres, but more particularly is it dependent upon the degree of luxury enjoyed.

Etiology.—The gouty state is frequently the result of hereditary transmission; in truth, this affection furnishes one of the most remarkable examples of this method of propagation of diseases, a fact which was fully understood by the ancient writers. In at least one-half of all cases the disease has existed in the parents or grandparents. Transmission from the male side is thought to be more frequent. Hutchinson in particular has called attention to the influence of age upon the ability to transmit the disease. The increasing intensity of the diathesis with advancing generations results in more typical forms of gout in the younger children of such parents, while those born in earlier life often manifest little tendency to the disease or escape it altogether. In this respect gout is the antithesis of syphilis. The transmitted tendency may be so strong that gouty developments appear even in early life and notwithstanding correct dietetic and general habits, but most children follow in the footsteps of their parents and indulge in habits of life which favor its development.

Age. While distinctively a disease of adult life, few cases appearing before twenty-five or thirty years of age, some develop even in young children. It is claimed that gout has occurred in nursing infants. As we have already observed, there is a direct relationship between the frequency and intensity of the disease and the age of the patient. According to the statistics of Pâtissier in hereditary gout, the first attack occurs most often in the thirty-fourth year, while in the acquired form it is delayed to the thirty-eighth year. Few cases develop after the sixty-fifth year. Many of these late developments of the disease are the result of a cessation of active life, but with little diminution in the amount of food and drink taken.

Sex. Women are much less frequently attacked than men. Of 580 cases collected by Durand-Fardel and Pâtissier only 20 were women. They are more frequently affected about the time of puberty and after the climaxis. Other forms of gouty development than the articular occur quite frequently in women during their menstrual life, and as they often develop during menstruation, and articular involvement seems to be in no way related to menstrual epochs, it seems reasonable to suppose that as many other developments in gouty women after cessation of the menses are due to age or condition attendant upon the same, viz., a greater degree of quiet without any reduction in the luxuries of the table.

Diet. Gout may be originated or the predisposed may suffer prema-

turely as the result of the kind and quality of food and drink taken especially if associated with insufficient exercise and time spent in the open air. These several exciting causes of gout are operative in various combinations in different cases. Excessive eating is probably more influential than any particular form of food, although of the decided influence of richly nitrogenous food stuffs, especially meat, there can be no doubt. Of this class beef is most pernicious. Undue consumption of sugar and starch is also thought to possess an unfavorable influence. Careful study, in many cases, of the terminal products and of the symptoms in connection with the food taken, has convinced me that the most pernicious diet is not the same in all cases. The influence of alcoholics especially in the production of acute attacks is a very frequent observation. Some have attempted to belittle their influence, but the reasoning cannot be accepted. The alcohol which these substances contain is less important than other elements, such as sugar, dextrin, etc. In wine-producing countries excesses by the poor laborers result only in alcoholism, indicating the importance of overeating and want of exercise as factors in the production of gout. The most objectionable of the various alcoholic drinks are rich wines such as port and sherry, also lighter wines such as champagne, burgundy and marsalla. Malt liquors are almost equally prejudicial. Porter is particularly so. Spirits possess the least influence. In Scotland and Ireland and other countries where whiskey is the prevailing drink gout is unknown, although in these countries there is less of overfeeding and more of active life in the open air.

Indolent habits involve a life of luxury within doors, consequently insufficient exercise, insufficient oxygen, with usually an excess of animal food. As a result, oxidation is impaired with an accumulation of nitrogenous products in the form especially of uric acid which is not readily eliminated by the natural route—the kidneys—and gout is the result. Many men avoid gouty manifestations as long as they lead active lives in the open air, but when this ceases, as the result of age, injury or illness, the enemy is quickly upon them.

Mental and Emotional Causes. Excessive mental exercise if associated with other predisposing factors possesses a decided influence, and the same may be stated of emotional disturbances, such as protracted grief, disappointment, sexual excesses which waste a large amount of nerve force, with consequent impairment of the nutritive powers and excretion.

Gout does not appear to affect with particular frequency persons of any especial temperament or general character, the thin, corpulent, nervous and phlegmatic appearing to be about equally affected.

Occupation and Social Position. According to English authors gout is no longer peculiar to the aristocrat, but is quite common among the well-to-do, and even among butlers, coachmen, etc., who are well fed and do not have sufficient exercise in the open air.

Many cases of gout are dependent upon the action of certain poisons, especially lead. The observation of Garrod that a large percentage of gouty individuals are, by reason of their occupations, exposed to the action of lead has been often repeated and the influence of this agent confirmed by its internal administration.

Development of Articular Crises. It is during the changing temperature of spring and fall that outbreaks of gout are most likely to occur. In those strongly predisposed, a single heavy meal or glass of wine may prove sufficient to provoke an attack. More frequently it follows upon a period of unusual freedom in diet. Anything which disturbs the normal balance of nutrition may prove the exciting cause of active symptoms. We may, therefore, enumerate disorders of any of the organs, especially those of the digestive system, constipation, suppressed perspiration, exposure to cold, overwork, mental or physical anxiety or grief, sexual indulgence, traumatism, or acute illness. Involvement of a joint undoubtedly predisposes to future attacks.

Gout is a widely distributed affection, being especially common in those countries possessing the highest degree of civilization and culture, notably England and Germany. For obvious reasons also, it is most frequent in large centres of population. It is less prominent in either very warm or very cold climates for the especial reason that the inhabitants of such countries are too poor to live in luxury.

Pathology.—The pathology of gout is not yet established upon a substantial basis. Theories of greater and greater intricacy appear during each decade. Its association with an excess of uric acid in the blood and tissues seems established. Beyond this point there is much divergence of opinion. Most authorities regard the disease as of a general character and dependent upon a diathesis which they call "arthritic," which diathesis may under the moulding influence of various causes develop gout, rheumatism and probably other forms of disease. Some regard gout as dependent upon lithæmia, which term was applied by Murchison to an excess of uric acid in the blood. A very small quantity of this acid is always found in this fluid. The exact form in which the excess exists is not known; most of it is in combination with sodium, but whether as a quadriurate or a biurate is undetermined. The former is freely soluble in the serum of blood, the latter feebly so, and, according to Sir William Roberts, readily crystallizes out of that fluid. This observer has proposed the word uratosis to express such precipitation of crystalline urates in the fluids and solids of the body, the slightest degree of which is abnormal. He believes that such crystallization may take place not only in the form of masses, but as isolated crystals which may circulate in the blood, becoming sources of irritation to various organs and tissues, and thus exciting thrombosis, visceral neuroses and many of the obscure features of the disease. He does not believe the saturnine uratosis to be the same as gouty uratosis.

The causes of uric acid accumulation, which we have seen to be the essential feature of gout, have been extensively investigated, but only partially solved. It is generally accepted that there is an increased production which is strongly suggested by the nature of the causes of the disease. That it is imperfectly excreted is quite as generally accepted. Imperfect elimination has been ascribed to various causes, but especially to a diminished alkalinity of the blood. This has been suggested by numerous observers, but recently championed by Haig, who attributes all of the phenomena of gout to the irritant action of retained uric acid. He thinks that this substance tends to accumulate in the liver, spleen and fibrous tissues, particularly those associated with the smaller joints, for the reason that these parts are acid, or at least relatively less alkaline than the blood and other tissues. Imperfect conversion of uric acid into less irritating products, or those more readily eliminated, is another view entertained, but with as yet little of support in fact. Duckworth believes that there is a gouty neurosis, and relates gout to a functional disorder of the nervous system, probably involving a portion of the medulla.

The tissue changes of gout are widespread, involving the joints, circulatory apparatus, kidneys, digestive organs, nervous system, subcutaneous tissues, etc.

The typical feature is an inflammatory affection involving certain joints and attended with the deposit of urate of sodium in the affected tissues. The active inflammatory attacks cannot be ascribed to such deposit, as they are found in joints which have not manifested changes of this character. Joints which have been repeatedly inflamed present the greatest amount of uratic infiltration. The cartilage over the ends of the bones is probably earliest attacked, appearing first as a simple opacity, which increases until the entire structure is involved, when the accumulation commences upon the surface, which becomes incrusted with a substance appearing much like fine, white, moist plaster of Paris. The extent of this incrustation varies from a few spots to a complete involvement of the interior of the joints, including the ligaments and much of the synovial membrane, the edges of which are protected by reason of their vascularity, the periosteum is involved, and some believe even the bone itself, although this is denied. With the progress of the disease the recurrent inflammation of the joint is less intense, but the deposit increases, to the formation ultimately of masses of considerable size. The tissues more external to the joint, viz., ligaments, tendons, etc., are gradually implicated, resulting in a steadily increasing enlargement, immobility and distortion of the joint. The masses of the sodium salt which form in connection with the joints and in other locations are called tophi. These excite irritation of the overlying tissues, with ulceration, destruction or gangrene in aggravated cases. Suppuration within the joint is unusual.

It is the small joints which are usually invaded, particularly the metatarso-phalangeal articulation of the great toe. The ankles and knees are occasionally attacked, rarely the hip; also the wrists and elbows, rarely the shoulder joint. In the small joints of the hands are witnessed the most remarkable development of chalk stones or tophi, the soft parts being often destroyed. In large and small joints the secretion may be transformed into a pasty or putty-like mass consisting of partially crystalline urates which may be discharged through sinuses. Secondary inflammation may result in ankylosis without much deformity. Tophi and diffuse infiltration of tissues also occur in many tissues and organs. Very interesting are those of subcutaneous origin, which may vary from barely appreciable granulations to those as large as a pea or a small nut. They may be found over the surface of the body generally and be discharged by an ulcerative process, but are most frequently observed in the tissues of the ear, also in the eyelids, alæ of the nose, tendons, bursæ, muscle sheaths or muscular tissues, aponeurosis, in the tissues of the larynx, sclerotic coat of the eye, in the meninges of both the brain and cord, in the kidneys, cardio-vascular structures, and digestive organs.

The kidneys are more frequently involved than any other of the internal organs, the morbid changes beginning at an early date. The alterations are those of interstitial nephritis plus the deposit of sodium urate or uric acid. The urate is first deposited in the tubules, gradually involving the basement membrane and finally appearing in the connective tissue between the urinary tubules. It appears as whitish lines of deposit. Uric acid exists as calculi in the pelvis of the kidney or in the renal parenchyma, or as crystals in the tubules. It often excites a coexisting catarrh.

The circulatory system may be involved in all its portions, the essential feature in these alterations being arterio-sclerosis. The heart hypertrophies, especially the left ventricle. Valvular changes may take place, with subsequent degeneration of the myocardium and dilatation of the heart. Uratic deposits may take place within the valves, but this is uncommon, probably on account of the high degree of vascularity of these tissues. The general atheroma so often observed leads to imperfect interchange between the blood and the tissues, with resulting impairment of nutrition, serious consequences developing most prominently in the heart and in the brain, favoring dilatation of the former and hæmorrhage in the latter, or cerebral degeneration independent of hæmorrhage. Varicose veins and hæmorrhoids result from alterations in the walls of the veins, and hæmorrhages and bloody effusions from degeneration of the capillary vessels. The stomach and intestines are often catarrhal, which is largely the result of excessive eating and drinking. The liver is frequently in a state of fatty degeneration, and cirrhosis has often been observed. The lungs constitute a point of attack. Bronchitis is common

and emphysema frequently develops in those past middle life. Uratic deposits take place in the meninges occasionally and may, by reason of pressure, excite neuralgia of an obstinate character, indeed such deposits may cause neuralgia in any portion of the body through the medium of the peripheral neuritis which is set up.

The most important blood alteration is the presence of uric acid, which at first may be detected only during acute exacerbations, but with full development of the disease it becomes a constant and prominent element in this fluid. There are cases of typical gouty lesions, however, in which this substance cannot be detected in the blood, also instances of its presence in quantity independent of gouty lesions. Uric acid cannot therefore be depended upon as a positive diagnostic test. That something much more than uric acid is required for the production of gout is evidenced by the large quantity found in the blood of persons suffering from other forms of disease without symptoms suggestive of uricæmia. Lessening of the red blood-corpuscles, deterioration of the serum, and a gradual reduction in the alkalinity of the blood due to the amount of acid it contains, are the morbid features of this fluid in cases of long standing.

Clinical Course.—This is most varied. In most persons the first acute development consists in an attack of inflammation of the metatarsophalangeal articulation of one of the great toes, which pursues a characteristic course and is followed by comparative health until a second attack; succeeding attacks developing at increasingly shorter intervals and being attended by an increasing distortion of the articulation (chronic gout). Both joints may be attacked, or other of the small joints of the feet or those of the hands. Occasionally the larger articulations are involved with ultimate complete or semi-disorganization. Such are some of the important features of the "*regular form*" of the disease. The "*irregular form*" presents a broad array of lesions and symptoms which vary at different periods of life. They may develop in persons subject to the arthritic form or in those who have not yet suffered in this manner. In persons affected with both forms a tendency is often noticed to alternate development, *i. e.*, when one group of symptoms is improved the other appears to be stimulated to renewed activity (retrocedent gout). Irregular gout includes inflammatory and degenerative changes and functional disorders, and may be acute or chronic in character. The great variety of symptoms and lesions and the various combinations in individual cases make it impossible to do more than enumerate some of them. Of the inflammatory lesions, bronchitis, gastro-intestinal catarrh, iritis, conjunctivitis, acute attacks of urethritis or of inflammation of the mucous membrane of the entire genito-urinary system, with albuminuria and crystals of uric acid or oxalate of lime in the urine, peripheral neuritis, cirrhosis, interstitial nephritis with uratic deposits, which may occur independently

of joint lesions, and a variety of skin diseases, constitute the most important members of this group. Of degenerative changes those involving the heart, bloodvessels and the nervous system are most important. Of functional disorders vertigo, migraine, asthma, palpitation of the heart, angina pectoris, and muscular pains and cramps may be mentioned.

Premonitory Symptoms. The acute gouty attack is often preceded symptoms which suggest its approach. Such indications are sometimes by observed to appear at intervals for some time previous to the first outbreak. At this time the patient is usually ignorant of their significance, but in subsequent developments, if wise, he will at once take steps to avert or control the coming storm. Their character is most variable. Most prominent are symptoms relating to the digestive organs, viz., flatulent dyspepsia, acidity, constipation, palpitation or distress in the præcordium, oppression or positive asthmatic attacks, nasal irritation and disorder of any of the nerves of special sense. There may be irritability, melancholy, vertigo, migraine, a sense of exhilaration or lack of mental vigor, disturbances of sleep, sensory disorders in the extremities, neuralgia, and muscular cramps or spasms. The urine is often diminished and deposits urates freely or crystals of uric acid or of oxalate of lime. There may be albumin, pus cells, epithelium and other evidences of transient catarrh of the urinary tract. Vesical hæmorrhage is not rare. These premonitory symptoms are so numerous and varied in their character that it can be safely stated that almost any functional disorder, and many inflammatory ones, may be precursors of acute arthritic gout.

Local Symptoms. The arthritic attack is usually developed during the night, generally after midnight. Pain is the first symptom and in most instances is referred to the metatarso-phalangeal articulation of one of the great toes. Rarely are both of these articulations affected, and still less frequently other of the small joints or some of the larger ones. The pain is excruciating, continues for some hours, when it abates and the sufferer may be able to sleep again. The pain is described as throbbing, tearing, mashing, burning, aching, etc. Sensitiveness to touch and even to the weight of the lightest covering, or to jarring, even of the bed, is bitterly complained of. The skin is reddened, often rosy or livid, hot and shiny. The swelling is often stated to bring relief, which is supported by the fact that with relief comes sleep, and upon awaking the following morning or forenoon the part is much enlarged. The swelling is due to œdema of the periarticular structures as well as to effusion into the joint and involves a considerable portion of the foot as well as the affected joint. The œdematous character of the swelling is indicated by distinct pitting upon pressure. During the day there is usually considerable relief followed by an increase of the pain during the evening, with relief again towards the following morning.

The general symptoms are pronounced. Fever is marked and pro-

portioned to the activity of the local inflammation. The temperature usually rises to 101° or 102° F., but the elevation is of short duration. Rigors are the exception. The appetite disappears, the tongue is furred and flabby, the bowels are constipated, the head aches, the face is pale, with sometimes a flush over the malar bones. Many patients are ill-tempered and may be slightly delirious at night. There may be cough, well-marked bronchitis, or evidences of hyperæmia over the base of one or both lungs. The urine is diminished, often slightly albuminous, abnormally acid, deposits amorphous urates, and the total elimination of uric acid for the twenty-four hours is decreased.

With or without critical events the symptoms diminish as early as the fourth to the sixth days or the attack may extend to ten days or two weeks, and in others, by successive involvement of different joints, the duration may reach several weeks. With subsidence of the inflammation there is desquamation of the epithelium if the attack has been severe, and a gradual return of the part to its normal appearance, although some change may remain even after a single attack, if it be severe or protracted. The toe-nail is sometimes thrown off.

Sequences of Attacks. After recovery from the acute symptoms it is not unusual for the patient to express himself as feeling much improved in comparison with his condition prior to the arthritis, perhaps as feeling much better than for a long time. The tendency of these arthritic attacks to repeat themselves is a prominent feature of gout. A recurrence may be delayed for a few months, or for one, two, or three years, but it ultimately occurs, often in response to abuse of the digestive organs, overwork, worry or other exciting cause. In most cases the paroxysms appear with increasing frequency, involve additional joints with progressively increasing deformity. The changes which characterize this stage of chronicity have been described in the section on morbid anatomy and need not be repeated here.

It is probable that these acute explosions of gout rid the organism of an irritant, the essential feature of the process doubtless being the destruction and elimination of uric acid. The excess of this substance in the blood is readily demonstrated by the procedure devised by Garrod, the steps of which are as follows: Into a small quantity of blood serum (half a drachm), drawn by blistering, cupping, or by venesection, put two or three drops of acetic acid and an equal number of fine threads. Cover well and set aside for about thirty-six hours, at an ordinary room temperature, when the microscope will exhibit the threads with crystals of uric acid attached. It has been observed in the early attacks of gout that serum derived from over the joint in the course of the attack of acute inflammation does not contain uric acid, while that taken from a distant part will give many crystals. This has been explained by the higher degree of oxidation taking place at the seat of the inflammatory

process. After the establishment of a chronic state, however, the inflammatory reactions grow less and less marked, and oxidation less perfectly performed until uric acid finally appears in the serum taken from the neighborhood of the inflamed joint. The relief which follows upon the arthritic crises also results from inflammation in other structures, *e. g.*, from acute bronchitis, tonsillitis, acute rheumatism, or some forms of skin eruption. These inflammatory processes also bring about increased oxidation and elimination.

Complications.—The various dangers to which the subject of chronic gout is exposed have been suggested in the paragraph relating to the morbid changes accompanying the disease. Especial mention should be made of those resulting from renal and cardio-vascular degeneration. These frequently coexist, and while one group may precede the other for some time, both organs present some degree of degeneration in all cases of protracted gout. The attending symptoms are those of cardio-vascular sclerosis and of chronic interstitial nephritis. Associated with these are usually symptoms dependent upon bronchitis, some form of pneumonia, uræmia, etc.

The *evidences of a gouty diathesis, independent of the known morbid changes* of this disease, may be apparent even in early life. The catarrhal attacks of the upper respiratory tract as well as of the bronchi, and the tonsillitis to which young children are subject, as well as urticaria, headaches, and articular rheumatism, are believed to be often due to inherited gout. With advancing years, come skin eruptions, acid dyspepsia, hæmorrhages, and pruritus ani.

Diagnosis.—The diagnosis of typical gout presents no difficulties, but the discovery of the gouty state prior to such developments, or the ability to characterize intercurrent affections as of gouty origin, often requires careful observation for a considerable period of time. The problems in diagnosis are therefore associated mainly with the detection of irregular or atypical gout. The very diverse character of these manifestations has been referred to. We must call to our aid under these circumstances the family and personal history and the habits of the patient relating to food, drink, exercise, etc. A history of a typical attack of gouty arthritis or of exposure to the influence of lead, or of lithæmia or glycosuria, or the presence of heart lesions, or of interstitial nephritis, assists greatly in forming an opinion. Tests for uric acid in the urine are important. We have referred to the value of Garrod's serum test during the course of the arthritic attack.

Rheumatism affecting a single joint, and especially a small joint, may simulate a first attack of gout, but this is unusual; and if the age of the patient, the history, both family and personal, the sex, occupation and social position of the patient, and the condition of the urine be considered, there is usually no difficulty in arriving at a proper conclu-

sion. There is an absence in gout of the profuse sweating and high fever of rheumatism. After repeated attacks of gout the diagnosis is rarely in question.

Rheumatoid arthritis. Subjects of this disease are usually youngish women who are free from a history of habits calculated to develop gout and of a hereditary tendency to that disease. Most are accustomed to labor and not to good living. It is a persistent disease, unlike the periodically appearing gout. It also attacks both small and large joints and progresses successively from joint to joint. With full development there is distortion and stiffness with grating on motion, and finally, there is no deposit of urates in the joint or in any of the tissues. The urine is free from evidence of renal disease. The serum does not yield uric acid.

Gonorrhœal synovitis occurs in young persons, is associated with a urethral discharge and is not attended by uratic deposits, tophi, or uric acid in the serum.

Prognosis.—After an acute outbreak of gout, which, in its uncomplicated form, is not dangerous to life, one of the questions which is certain to be propounded will be in reference to the probability of future attacks, as most patients are fully aware of the recurring nature of the disease. In rare instances there may be one attack only, but it must be confessed that when the hereditary tendency is strong, attacks will be repeated, even with an exercise of proper dietetic and other precautions. It follows, therefore, that gout does not respond readily to treatment. Those cases least likely to recurrence of acute symptoms are free from a strong hereditary taint, the disease has developed late in life, and is probably the result of over-eating and other bad habits which the patient is able to correct. If the hereditary tendency is strong and the patient has already had repeated attacks, and especially if the joint changes have progressed to the development of tophi, little encouragement can be extended that more than relief and some arrest of progress will follow the best directed efforts. The duration of life depends largely upon the condition of the heart, arteries, and kidneys, death being the result in most instances of the breakdown of these vital organs. The probability of their involvement is much greater if there have been frequent attacks of arthritis, or if the hereditary taint is strong. When gout is developed early in life, death often occurs from uræmia or cerebral hæmorrhage by middle age. If the gouty diathesis is detected before a decided outbreak of any kind, and the hereditary tendency is not too strong, the individual may, by strict adherence to proper diet, exercise, etc., and prompt treatment of all symptoms, hope to overcome the disease and remain free from its manifestations; but even after years of conscientious care on the part of both physician and patient, uncontrollable factors, such as taking cold, a period of overwork, or of intense worriment, may precipitate a development of the disease in some form.

Treatment.—The tendency of some clinicians to allow the attack of gout to pursue its course without treatment, or with the aid only of medicines for the control of pain, is unwise. Every effort should be made to shorten and lessen the intensity of the inflammatory process and thus to limit to the minimum the morbid changes in the joint. The patient is usually first seen during an acute attack when means for immediate relief must be considered. He should remain in bed with the affected extremity elevated and enveloped in carded cotton surrounded by oil-silk, which retains the moisture, developing a kind of vapor bath (Garrod). Some advise moist applications containing morphine, atropine, or both; indeed, a great variety of local medication is advised, the value of which is very questionable. The bowels should be moved, if necessary, by means of some saline water, such as Hunyadi Janos or Carlsbad. If there is no contra-indication *colchicum* should be administered, as there is no known remedy which possess a tithe of its influence over the arthritic manifestations of gout. It is antagonized by some homœopathists on account of the material doses which are required and, perhaps, for the reason that it is so generally administered and abused by the old school. Colchicum has also been spoken lightly of by some of the latter class, many of whom, like Trousseau, have thought it better to allow the attack to pursue its course uninfluenced by medicines; but this is the history of every remedy of value and of the treatment of all important forms of disease. The use of too large doses of this drug and the endeavor to subdue all cases by its use are responsible for some waning of its popularity. If ten-drop doses of a good tincture repeated every two hours do not afford relief it is wise to discontinue the medicine. One to three-drop doses often prove successful. Occasionally, in typical cases of great-toe gout, with a heavily coated tongue, nausea, possibly vomiting, colic or diarrhœa, colchicum in the first decimal dilution gives prompt results. Cases with marked gastro-intestinal disorder do not often tolerate the larger doses well. My personal experience is much greater with *colchicine*, which I usually give in the third decimal trituration, repeating one-grain doses every one-half to two hours, as required. The smallness of the dose and its pleasant character as compared with that of the tincture of colchicum strongly commend it. Its favorable action is also fully equal to that of colchicum.

If a rather sthenic patient is beside himself with the pain, and is restless, flushed, etc., a few doses of *aconite* may be of service in the early stage, or *belladonna* if the pains are of a throbbing character, but whatever remedy is given in this manner it is generally found that colchicum or its product must be resorted to if the attack is to be materially shortened.

Mercurius dulcis had better be administered if there is a heavily coated, flabby tongue receiving the imprints of the teeth, tenderness of

the epigastrium, loss of appetite, even loathing of food, constipated bowels, etc. The first decimal trituration in grain doses should be repeated hourly, ceasing if the bowels are acted upon. *Arnica* is recommended by all authors when the attack is precipitated by injury. Such origin is unusual, and the suggestion smacks of theory; notwithstanding this I cannot condemn its use for lack of experience with it. I am satisfied that *bryonia* possesses some power over the acute outbreaks. Its general applicability to the arthritic lesion is apparent. It is of equal value in internal inflammations of a gouty character. Stitching pains aggravated from the least motion or from touch, a furred tongue, tender epigastrium, and nausea and light head on rising in bed, are important indications. Drop-doses of the tincture, frequently repeated, are most efficient. The tincture of *berberis* also has appeared beneficial for the arthritis, especially in cases associated with a tendency to renal outbreaks, viz., oxaluria, lithuria, attacks of catarrh of the genito-urinary tract, with painful urination and pain along the line of one of the ureters or in the region of the kidney. Berberis acts favorably upon the renal condition as well as upon the arthritic.

Benzoic acid and *benzoate of ammonium* when the urine is strong in odor, dark in color, of high specific gravity, and depositing much uric acid. *Benzoin* I have found admirable for attacks of mild intensity, *i. e.*, little redness or swelling, but tendency to persistence. In several cases of involvement of the fingers its action has been pronounced. The tincture on sugar or disks is the best method of administration. *Guaiacum* employed in the same manner may be considered, if benzoin is not beneficial.

The treatment of the patient prior to the development of frank gout and in the periods intervening between the acute outbreaks, is most important, far more so than that of the acute outbreak. This general care and treatment of the gouty should extend even to children of gouty parents, which will have the result at least of retarding and in some degree of lessening the intensity of the outbreak. The most important item is the proper regulation of habits of diet, exercise, etc. A life of judiciously active exercise in the open air, free from great exposure, possesses the greatest influence over the development of the disease and permits of a greater latitude in diet. Its favorable action is mainly due to improved oxidation. Moderate use of nitrogenous food, taking meat only once daily, and employing but little of that which is red, also of sweets and starch, are the essential dietetic measures to be advised. Too rigid a diet is not successful in all cases. Idiosyncrasies must be considered. Heavy meals in the latter part of the day are objectionable. It is better to prohibit alcoholic liquors. If it is thought best to allow a small quantity, old whiskey well diluted and taken with food is the least objectionable. Coffee often disagrees, which is largely due to the quantity taken and to the addition of sugar and cream.

Nearly all gouty persons, especially after middle life is reached, are dyspeptic, which disorder should receive thorough attention. An aggravation of the dyspepsia often precedes outbreaks of acute gout, which may be often prevented by the use of a very rigid diet for a short time, and such medicines as *nux vomica, pulsatilla* and *lycopodium*, all of which are important remedies in antagonizing the gouty diathesis. For the various manifestations of a typical gout good results often follow the administration of *colchicum* or *colchicine* and other medicines employed for the arthritic form and other acute developments, but in the main they must be prescribed for, in so far as drugs are concerned, as if unconnected with the gouty diathesis. It must never be forgotten, however, that in all cases the essential treatment relates to the diet and habits of the patient.

The association of headaches, vertigo, epilepsy, peripheral neuritis, various affections of the chest, including palpitation, valvular disease, arterio-sclerosis, throat affections, diseases involving the renal and uterine organs, must be kept in mind, as it is often advisable to test the influence of treatment directed to gout, in refractory cases of these and other troubles.

Apis, ammonium phos., calcarea carb., cinchona, eupatorium perf., iodine, ledum, kali hydr., lithium carb., natrum phos., rhododendron, rhus tox., sabina, staphisagria and *sulphur*, have all been recommended as applicable to the arthritic development in its various stages and for the irregular developments of gout, the remaining remedies of the materia medica.

The use of *morphia, acetanilid*, and other similar drugs for the control of the pain, is a common practice, but must be seldom necessary.

After recovery from the acute symptoms some benefit may follow very gentle massage or elastic pressure in some form. Improvement also follows a stay at some one of the mineral springs. These must be selected according to the object to be attained, and can only be intelligently prescribed after a study of their character and of general clinical experiences gained at the various kinds of springs. This must be learned from special works. In a general way, it may be stated that abroad, Vichy, Carlsbad, Marienbad, Baden-Baden, Ems, Kissingen and Teplitz may be considered; and in this country, Saratoga, Crab Orchard, Capon, etc.

ARTHRITIS DEFORMANS.

Synonyms.—Rheumatoid arthritis; rheumatic gout or chronic rheumatic arthritis; osteo-arthritis.

A chronic disease manifested in the joints, with the causes of which we are not acquainted, characterized by changes involving the articular cartilages, bones, synovial membrane, and the peri-articular structures, and resulting in marked deformity.

History.—Arthritis deformans undoubtedly prevailed in the early ages, which is learned not only from history, but from bones unearthed during excavations of ancient cities; of such evidence we may mention those secured from the ruins of Pompeii by della Chiagi, also by Petrie in his Egyptian explorations. These latter undoubtedly came down from the remotest days of Egypt.

While the early medical authors recognized the peculiarities of this affection it was not until the time of Sydenham that a full and excellent account of the disease was written, such a one appearing in the works of this eminent man. According to Charcot, Landré Beauvais, who in 1800 presented a monograph to the Faculty of Paris, which considered the pathological anatomy of this disease, was the first to recognize arthritis deformans as a distinct disease, he being the first to describe fully the changes taking place in the bones, cartilages and other structures involved. Following this period numerous excellent monographs have appeared, written by a large number of observers of whom we may mention Heberden, whose name is associated with the articular nodosities, Cruveilhier, Key, and especially Adams, Robert Smith, Charcot, Garrod, etc., as having done much to advance our knowledge.

Etiology.—Of etiological influences *heredity* may be first considered. Although it is very difficult to secure satisfactory evidence regarding the existence of disease in persons who are in many instances deceased, still a careful consideration of such information as we possess indicates that hereditary influences possess considerable importance in determining the development of this affection. Out of a series of 500 cases treated by the late Dr. Garrod some sort of a history of heredity could be secured in more than one-third. It is not an infrequent observation that several cases are treated in one family. I have several times had under treatment two children of the same parents; also persons, one of whose parents suffered from arthritis deformans, and under circumstances which made it improbable that both were alike subjected to exciting causes of the disease. Whether the tubercular diathesis possesses any influence in favoring its development is very doubtful, although it has been contended for.

A certain number of cases occurs as a sequence of acute articular rheumatism, the latter seeming to merge directly into arthritis deformans, or the latter develops after periods of remission and aggravation of what appears to be rheumatism, extending over a period of months. Such a close relationship does not exist between gout and arthritis deformans.

The highest degree of susceptibility occurs in middle life. Few cases appear before the thirtieth year, at least this is the usual statement of authorities. My own experience conflicts with this, having met a

large number of cases developing between the ages of twenty and thirty. I have had under my care three medical students, each showing the disease before twenty-three years of age, and a number of girls and young women developing the disease before this age. Without possessing accurate statistics of my own relating to this point, I should say that the number of cases appearing between twenty and thirty has been fully as great as during the next decade. The largest number of cases undoubtedly develop between the ages of forty and fifty, the number quite rapidly diminishing during succeeding years, such diminution being more marked in females than in males. In women the disease is especially apt to occur at about the time of the menopause, and it is not uncommon to find it associated with various forms of pelvic trouble. The relationship existing between the two is uncertain, possibly both are incident to the same diathetic condition.

The susceptibility of women to the disease is very much greater than that of men in the proportion of about one to four, and their increased liability is somewhat greater, as we have seen, during the fifth decade of life.

The relationship of arthritis deformans to the nervous system is a question of great interest, but concerning which we as yet possess little information, except that the joint lesions are closely related to certain arthropathies developed in the course of locomotor ataxia, paralysis agitans and hemiplegia. It is not uncommon for arthritis deformans to follow upon periods of emotional depression, protracted overwork, especially of a mental kind, and conditions of impaired vitality from many causes.

There is a general impression that protracted exposure to cold and damp is an active factor in the excitation of many cases, particularly if associated with overwork, unsanitary surroundings, etc. But the influence of this factor is not as great as supposed, if we may judge from recent statistics, which seem reliable and which indicate that a history of the disease developing from cold cannot be secured in over one or two per cent. I have observed its appearance in persons who live or work in damp buildings, *e. g.*, in cellars or below the surface of the ground.

Excessive eating, drinking, and other habits found to excite the development of gout possess no influence in the production of arthritis deformans. This has led, in this country at least, to the popular appellation of "poor man's gout."

The influence of certain infectious diseases, especially influenza, in developing this form of arthritis, has been observed particularly since the epidemics of recent years. An older observation is that of the production of arthritis deformans by injury in the nature of a blow or strain, which is especially liable to excite the mono-articular form. I have several times observed in these cases a later involvement of the corre-

sponding joint, *e. g.*, a gentleman riding horseback had one of his knees slightly injured by the fall of his horse, followed by the characteristic manifestations of the disease, and within one year its gradual development in the other knee. There had been entire freedom from any suspicious symptoms prior to the injury.

Pathology and Morbid Anatomy.—Most varied opinions are advanced as to the essential nature of arthritis deformans. Many authorities are inclined to look upon it as due to some variety of the arthritic diathesis and as closely related to rheumatism, which it quite frequently follows, but the close clinical relationship which exists between this disease and those arthropathies which develop in the course of certain affections of the nervous system, have led others to regard it as possessing a nervous element in its pathology and characterized by a dystrophy of the articulations, muscular and other related tissues (Ord and A. Garrod). By such the lesions within the joints and the associated atrophy of muscles are looked upon as results of the same morbid process. That the disease is distinct from rheumatism and gout seems to be the prevalent opinion, although Hutchinson would make it a compound of gout and rheumatism, and many observers, both English and French, regard it as a form of rheumatism.

The joint changes are quite characteristic and begin in the cartilages covering the articular ends of the bones and somewhat resemble those of senility in kind. Fibrillation of the intercellular substance of the cartilage, giving rise to a soft velvety surface, is the first change to appear. This is brought about as the result of a proliferation of the cartilage cells throughout the matrix, with the formation of capsules about many of those cells, within which are fashioned secondary capsules which may be grouped and surrounded by envelopes, or be isolated. The primitive capsules approaching to the surface of the cartilage rupture into the joint cavity, or several may rupture into each other with the formation of numerous minute tubules in the cartilage, consequently the ultimate breaking up of the cartilage into filaments. Friction now brings about rapid disintegration of the structure which first disappears near the centre of the articular surface, this continuing until more or less of the cartilage is entirely destroyed. With the destruction of the cartilage changes take place in the articular extremity of the bone, the result of which is eburnation. Just how this is brought about is not quite certain, thoug hit has been ascribed by Cornil and Ranvier in some degree to inflammatory changes, but they believe that during the progress of the changes in the cartilage there is a discharge into the deeper medullary spaces, which, increasing in size, produces pressure upon the bone which intervenes and so brings about its absorption, which is evidenced by the presence of deep grooves which are arranged in a parallel manner and in the direction of motion of the joint. The exposed surface of bone is ex-

tremely hard, becoming polished by the continued friction, and presents here and there minute openings representing the bone canals. The peripheral margin of the cartilage being unable to discharge its cells into the articular cavity, they accumulate, with the result of the formation of cartilaginous growths, called chondrophytes, which after ossification are called osteophytes, and add greatly to the deformity of the joint.

The synovial membrane undergoes thickening, its fringes are hypertrophied and contain cartilaginous bodies or little fatty masses. The former are, many of them, attached by elongated pedicles, some of which may rupture. This is in the origin of the small cartilaginous bodies so frequently found in these joints.

While in many instances the affected joints contain little or no fluid. which has given rise to the application of the term "dry arthritis" to this affection, in a considerable percentage of cases there is an increased amount of this substance. It is not uncommon to find the knee joints greatly distended, and occasionally joints of smaller size, also in rare cases even the small joints of the hands. The adjacent bursæ may contain fluid.

The joint is stiffened, creaks when moved, and in advanced stages of the disease there may be distinct grating. Aside from these intra-articular changes it must be noted that all related tissues undergo a certain amount of change, *i. e.*, muscles, nerves and fascia. The muscles present the atrophic changes which characterize the progressive muscular wasting of central origin, although we have not yet been able to establish a relationship between this disease and the central nervous system.

Associated lesions are most frequently found in the kidneys, lungs and heart. Cardiac changes are stated by some observers to be rare, while those who hold to the rheumatic origin of this disease cite the frequency of their occurrence as one of the proofs of rheumatic origin. My own observations indicate its infrequent occurrence, except in persons who have long been subject to marked lesions. In some of these renal disease has existed, with which the heart changes may have been more immediately connected. There seems to be some etiological relationship between interstitial changes in the kidneys and arthritis deformans, but the relationship is not so clear between that affection and tuberculosis. In a few instances the pathological changes may be limited to a single articulation, or to a very few, but more often many joints are involved, especially the smaller joints, *i. e.*, those of the hands and feet (multiple arthritis deformans).

Deformity is dependent not only upon the changes in the joint, but also upon muscular spasm and atrophy. These symptoms are apparently of a reflex character, which Gowers considers the only acceptable explanation. The spasms involve muscles related to the diseased joint which is rendered additionally painful thereby.

Symptoms.—The phalangeal joints of the upper extremities are

usually the articulations first attacked. The pronounced joint lesion may be preceded for some time by fugitive pains, a little tenderness or trifling swelling at some point, which disappears entirely and perhaps for months prior to the outbreak, which may involve one or all of the terminal joints of the fingers. In this early stage there may be some disorder of digestion, some acceleration of pulse or irritability of the heart; or there may be muscular cramps, neuralgic pains, local sweats, muscular pains here and there, especially about the chest walls; a snapping in the cervical region during certain motions of the head, etc. The affected joints are stiff and painful, and soon manifest marked swelling which goes on to decided deformity. Whether the small joints or the large joints or both are attacked, there is in most instances a lessening of symptoms in the course of weeks or possibly months, but the articulations are not restored to their normal size and condition before active symptoms again develop, resulting in greater changes than those occasioned by the primary attack. This development by means of waves of inflammation, of a subacute character, continues until changes in the affected joints have attained a high degree, when progress is freer from these marked fluctuations. Notwithstanding the activity of the symptoms and the presence of several foci of inflammation the fever is trifling or entirely absent, as is the profuse sweating which is so marked a feature of articular rheumatism. The various complications of that affection are also rarely met in arthritis deformans. It is not uncommon, especially in those who have reached early middle life, to find a limited number of the large joints involved, more often the knees. In these subjects there is frequently an entire absence of deformity in the small articulations. A marked feature of the progress of the disease is its involvement of corresponding joints, *e. g.*, both knees are usually involved, or the same finger joints of both hands. This symmetrical development extends in some instances even to the portion of the articulation involved, but is not inconsistent with a higher grade of lesion on one side.

Charcot noted the tendency of the lesions to progress centripetally, *i. e.*, beginning in the smaller peripheral joints and gradually involving those of larger size. Next to the small joints of the hands, the knees are most frequently attacked, these articulations manifesting a special susceptibility to early involvement in many forms of arthritis. Next in order we may enumerate the feet, then the ankles, wrists, elbows, shoulders, and last of all, the hip joints. According to Garrod's statistics the cervical spine is involved in about 35 per cent. of all cases, and of remaining articulations the temporo-maxillary is attacked in one-fourth of all cases. The dorsal spine and the sterno-clavicular articulations are but seldom affected.

The diseased joints become less and less mobile. In the early stage

impaired movement is the result of the pain which is excited, but later the anatomical changes in and about the joint seriously cripple movement. In a very small number of cases ankylosis is ultimately established, but is very seldom of the true variety. When many articulations are involved the condition of the patient is pitiable. It may be impossible to close the hand, move the wrists or elbows, bend the knees or ankles, or even to sit down or stand, but the unfortunate must lie like a fallen image until moved by an assistant. The temporo-maxillary articulation may be much stiffened, preventing chewing motions, and it is sometimes necessary to extract teeth to permit of the introduction of nourishment. Involvement of the cervical spine may result in a drawing of the head to one side, due to spasmodic action or contracture of muscles. Sometimes the head is rigidly fixed in one position.

The deformities growing out of the joint changes in association with atrophy, spasm and contracture of muscles, present great variety. Considering first those developed in the upper extremity, it may be noted that the terminal digital articulations assume a cuboidal form, the middle digital joints are more rounded, and frequently partially dislocated. The knuckles manifest an oblique dislocation which is toward the ulnar side. The lower extremities of the bones of the forearm are prominent in a backward direction, leading to abnormal fulness of the dorsal surface of the wrist. The wrist changes are complicated by bursal distention and carpal enlargements, and still further by atrophic changes in the muscles of this region. If the elbow joint is attacked it is swollen, may contain fluid, also accumulations in the bursæ, which are apparent over the olecranon process. At the shoulder joint enlargement is seldom a feature, rather wasting of the deltoid muscle and other tissues covering the articulation. It is not unusual for the head of the humerus to occupy a position somewhat anterior to and above the normal position, giving rise to a depression posteriorly. In the lower extremities we note nothing of importance below the knee, which articulation is often much swollen by reason of effusion into its cavity. This, after a time dimishes or disappears, when it is possible to discover that the joint is deeper and broader than normal, due to the osteophytic development in its periphery. Quite sharp articular lips may be detected, especially at the lateral margins of the articular surfaces. The hip joint is one of the last to succumb to the disease, but develops very characteristic conditions, notably shortening of the limb with eversion of the foot and flattening of the gluteal region. It is not rare for this joint only to be attacked, especially in old men who have received an injury of the joint, the symptoms resembling those of hip disease.

A careful consideration of the conditions existing in and about the joints reveals the fact that the enlargement of the articulation is due in the more acute cases very largely to an increase of fluid in the cavity of

the joint, as well as in related bursæ, which latter may indeed be connected with the joint; that in other cases, and especially with protraction of the disease, hypertrophy of the synovial membrane and changes in the periarticular structures are prominent, and that with still greater chronicity, the fluid disappears from the articulation and osteophytic developments appear about the joint.

Further changes result from muscular spasm, which may be early associated with changes in the articulations. The proof of the existence of spasm is readily furnished by the use of an anæsthetic. I observed a young woman whose temporo-maxillary joint was sufficiently stiffened to prevent mastication, yet who, with the progress of anæsthesia, moved the jaw quite freely. The influence of muscular atrophy has been referred to.

Symptoms of a general character are not very prominent until the disease has existed long enough to develop a considerable degree of anæmia and general debility. The anæmia may sometimes be very prominent and of a progressive character. Such cases do badly. In those running a rather rapid course fever may be pronounced, but is seldom continuous. The pulse is increased in frequency, even during an early period of the disease. This early acceleration of the heart is considered by Spender as an important symptom of the early stage, and may be independent of any rise in temperature. It may be associated with palpitation. The same observer has also called attention to a pigmentation of the skin in the region of the affected articulations, which is developed in spots, and which may be nearly black; but while this development may appear in connection with joint changes of this character, they have also been observed in persons not suffering from arthritis deformans, and cannot therefore possess a high degree of diagnostic importance. The nails may show longitudinal striations or other evidences of malnutrition. Local sweatings are not uncommon, and dropsy of the lower extremities has occurred independently of renal or cardiac disease. Subcutaneous nodules similar to those observed in articular rheumatism are occasionally present, which fact has been employed in support of the doctrine that arthritis deformans is of rheumatic origin. They have been variously explained, some considering the initial disease to have been rheumatism, which merged gradually into arthritis deformans, while others have advanced the idea that the two diseases might coexist. It is thought that the nodules of arthritis deformans are more apt to be tender than are those associated with rheumatism, and that in the former disease their persistence is far greater. The general condition is one of miserableness. The patient is often thin, the features appear sunken, the skin is dry and rarely perspires, except the hands, which often sweat profusely. There is a complaint of feeling cold, and a sensitiveness to cold, the extremities often manifesting impairment of

circulation. In rare instances the articulations within the ear are involved, leading to impairment of hearing, and those of the larynx to altered voice.

The duration of the disease is very long, and must of necessity be so, as death never results from uncomplicated arthritis deformans.

Diagnosis.—The diagnosis is ordinarily easy. From gout it is separated by the presence in the latter of uric acid in the blood, tophi about the joints, and a history of habits calculated to excite its development. In gout, the lesion is usually first apparent in the lower extremities, while in arthritis deformans, it is in the upper. The family and personal history of the patient is often of great assistance. Gout usually appears in men, while arthritis deformans more frequently attacks women. From chronic rheumatism, by the absence in the latter of the characteristic articular alterations which have been described; but there are periods in the development of these affections when, for a time, it may be impossible to distinguish positively between them. The infrequency of cardiac complications in arthritis deformans should be remembered, also its symmetrical development and the involvement of the temporo-maxillary or upper spinal articulations in about one-third of all cases. Tubercular disease may, for a time, simulate arthritis deformans, but the peculiar deformities of the latter are not observed.

Prognosis.—We have seen that danger to life is not great. In very active cases anæmia may become a prominent symptom and the patient grow very weak, but if the case proceeds to a fatal termination it is through the mediumship of some complicating condition. Spontaneous arrest is not infrequently observed, which warns us not to claim too much for treatment. If skilfully treated, however, the disease is not only, in most instances, lessened in severity, but may be arrested and occasionally entirely removed. Those cases which respond least to treatment occur in persons advanced in life, but this very class progresses slowly, although terminating often in high degrees of deformity. I have repeatedly seen entire removal of the symptoms in the more acute cases, particularly those involving the knees. It is better, however, not to express an opinion of a prognostic character until one has tested the responsiveness of the patient to treatment.

Treatment.—Active therapeutic measures should be instituted early and continued with great perseverance. The exceedingly chronic nature of the disease must be kept in mind and treatment correspondingly regulated, else little will be accomplished. The patient's general life should be carefully regulated as to diet, exercise, sleep, etc. Contrary to what we have seen to be necessary in gout the patient should be well fed with the most nutritious food, which should be especially rich in fats, particularly milk, cream, butter, fat meat, cod-liver oil, etc. Oils may be advantageously introduced through the skin. Further

dietetic measures must be determined by the particular condition of the patient; *e. g.*, it is essential to keep the amount of urine up to the physiological standard, which may often be most satisfactorily accomplished by the use of a mineral spring water; dyspeptic conditions may require a lessening of starch and sugar or of nitrogenous matter. Alcoholics are not objectionable if indicated. A change of climate is often of great benefit, the desirable features of such a climate being mildness and dryness. Considerable altitude is sometimes apparently beneficial. Such change of climate may often be combined with the employment of a mineral spring water internally or in the form of baths. At home, warm baths should be taken rather freely, and we may follow the example of certain observers and add a drachm of arsenite of sodium to the bath and, perhaps, combine it with two or three ounces of bicarbonate of sodium. I have, however, observed no better results from this plan than from the plain baths. The patient should be carefully rubbed and manipulated while in the bath. In many cases judicious massage repeated daily appears to be of much service. In some instances good follows the use of Turkish baths, or baths associated with electricity. A local steaming or application of hot dry air to the affected joints is sometimes helpful. Galvanism proves of some service in the relief of pain, when applied directly to the affected joints, but beyond this temporary relief I have observed little good except when applied to the spine. In a number of instances the daily use of a current of about twenty milliamperes has appeared to be of decided benefit. The current is applied for about fifteen or twenty minutes through the length of the spine, moving the electrodes just sufficiently to avoid irritation. In some cases I have employed shorter circuits, *i.e.*, including not more than six or eight inches of the spine at one time, this method requiring frequent movements of the electrodes.

Colchicine has proven a most effective remedy when the inflammatory changes have first appeared in the terminal finger joints, attended by swelling, slight sticking pains and sometimes redness. The best results have been secured in the treatment of the subacute attacks involving the knees or some of the larger joints, and attended with considerable effusion. These cases are often associated with some degree of alteration in the terminal rows of the finger joints and with other symptoms of arthritis deformans. A large percentage of the cases of this character which I have seen have existed in young adults, at least persons under forty years of age. Of a dilution prepared by adding one grain of Merck's colchicine to one ounce of alcohol, give three drops every two to six hours. The medicine should be carefully watched in order to avoid the production of any annoying symptoms. A flannel compression bandage is of some assistance when the large joints contain much effusion. These results with colchicine have been attained without

the aid of accessory measures of any kind, with the exception of directing a proper diet and general conduct.

Benzoin has been useful in some cases not helped by colchicine. It is best administered in the tincture on disks. Good results have followed the use of *benzoic acid*, also the *benzoates of lithium* and *ammonium*. The two last medicines I have been in the habit of giving upon the symptoms calling for benzoic acid, mainly the high-colored, strong-smelling urine, and chronic bronchitis.

The large percentage of women, and of women who have uterine disease of some form, suffering from arthritis deformans, has suggested a resort to such medicines as *pulsatilla, actea rac., calcarea carbonica, sabina, sepia* and *sulphur* in its treatment, and with considerable result. *Pulsatilla* has given me some of the most satisfactory improvement I have secured in the treatment of this disease. It is best suited to cases in which the knees or other large joints are involved without much effusion or very severe pain. The patient is very chilly, has cold extremities, wet palms, may have the pulsatilla dyspepsia, and some form of uterine disorder, the most important being scanty and delayed menstruation. *Sepia* follows pulsatilla well and is given for much the same general symptoms, but is better suited to cases with portal and uterine congestion. There is a feeling of fulness in the abdomen, bearing down in the pelvis, and constipation with the sense of a lump in the rectum. The urine deposits a reddish sediment which requires to be scoured from the vessel. *Collinsonia* may be selected for similar cases if there is constipation, hæmorrhoids, dysmenorrhœa and involvement of the small joints.

Calcarea carbonica and *sabina* are better suited to women with profuse menstruation. The former must be selected more especially upon the general bodily characteristics, and the latter mainly upon the profuseness of the menstrual flow, although it is an efficient remedy for active joint lesion, even independently of uterine symptoms. *Actea rac.* is given largely upon the recommendation of Ringer, who considers it a medicine of great value in these cases. There are swelling and deformity, little or no fever, and aggravation of the pains at night. In the early stage of the slowly developing lesions of the small joints I have repeatedly observed relief from *calcarea sulph.*, 6x, repeated three or four times daily. It follows colchicine well after that remedy has relieved the more active symptoms. In this class of cases it is difficult to estimate results, as the disease often comes to spontaneous arrest after involving one or many joints. A single experience with *chloride of gold* has impressed me with its possible value in this disease. There are several reasons why it should prove useful. I have not observed as much benefit from *sulphur* as many report. The *iodide of sulphur* appears more useful, but we have few symptoms upon which to prescribe it.

Ammonium phosphoricum I have little experience with, it is, how-

ever, recommended for swelling of the joints of the fingers, hands and back, with evening fever, failure in flesh and strength, loss of appetite and sleeplessness. *Causticum* is also suggested for nodes on the joints with stiffness, swelling and contractures. The pains are improved by warmth and aggravated by cold air.

Calcarea phosphorica, guaiacum, ledum, manganum, natrum sulph., natrum phos., rhododendron have all been commended, but I am unable to express opinions concerning them founded upon experience. *Iodide of iron* possesses the best reputation among old-school remedies, and I have given it in the form of the syrup with undoubted advantage.

SCURVY.

Definition.—An acquired disease dependent upon a dietary deficient in fresh vegetables, and characterized by a high degree of debility, anæmia, swollen spongy gums, ecchymoses in the cutaneous structure, fibrinous exudate into deeper parts, a tendency to disintegration of tissue, and hæmorrhage from free surfaces and into internal organs.

History.—Scurvy is a disease of greater historical than present interest, for, if we except the so-called scurvy of infants or cases seen in time of war—one rarely meets a case manifesting scorbutic phenomena on land and in civilized countries. Many physicians of long experience have never seen a case of scurvy. This rapid disappearance of the disease during the present century has been due to the better understanding of its etiology and the application of this knowledge to its prophylaxis and treatment. Accounts of disease which may be recognized as scurvy do not antedate the thirteenth century. The details of these early epidemics indicate great loss of life and intense suffering. The disease has been an attendant upon great armies, bodies of people congregated together under unfavorable conditions, and especially ships' crews upon long voyages. Since the opening of the present century, however, scurvy has rapidly diminished until the entire number of cases developing in the combined naval forces of the world is less than one in two thousand cases of all sickness. The enactment of laws looking to the better supplying of anti-scorbutic food to the merchant marine, has greatly diminished the disease in this class during the past decade. The reduction of the disease among land forces has not been as marked, due to inability to so thoroughly control the conditions to which soldiers are subjected. During our civil war scurvy represented nearly 6 per cent. of all cases, and other campaigns of recent times furnish about the same percentage. This is in marked contrast with earlier days, when armies often lost more men from this affection than from the weapons of the enemy.

Etiology.—The theories which have been advanced concerning the causation of scurvy are very numerous and constitute amusing reading, but all theories which do not recognize the pre-eminent influence of the

absence of fresh vegetable matter from the dietary as the essential exciting cause of the disease must be considered unsatisfactory and as not in accord with the opinion of the great majority of observers. Other factors are accessory or predisposing only. Of these we may mention depression of nutrition from any cause; worriment, fright, etc., all of which lessen the individual's power of resistance to disease in any form. Such causes are especially apt to be operative in unsuccessful armies, *i. e.*, after defeat, also in houses of detention, if associated with improper diet and sanitation.

Impure air has been looked upon as a cause of scurvy, but it too must be relegated to this class of favoring conditions, and the same must be stated of cold and damp, both of which at one time held sway as the essential causes.

The dependence of scurvy upon infection has been advocated, but there appears to be little to support this theory beyond the fact that the disease develops under circumstances similar to those under which members of the infectious group develop, *i. e.*, in association with bad hygienic surroundings.

Men are more often attacked than women for the reason that they are more exposed to the favoring conditions. All ages succumb, even infants, although the aged manifest the highest degree of susceptibility.

None are exempt from the disease if subjected to favoring conditions, for it has appeared in all countries and classes of society. It is met in all zones and may be sporadic, endemic, or epidemic in its appearance.

There are no grounds for a separation of scurvy into varieties, as that met among sailors differs in no essential respect from the disease as developed upon land.

Pathology and Morbid Anatomy.—Notwithstanding the positive character of our knowledge respecting the etiology of scurvy, we are still unable to indicate the element contained in vegetable food which is so potent in the prevention and cure of this disease, nor are we any wiser in regard to the intimate nature of the changes occurring in the blood and tissues.

Garrod noted the greater percentage of potassium in the scorbutic as compared with the antiscorbutic dietaries, also the diminished quantity of this substance present in the urine and blood of scorbutic persons, which led to the development of a theory that scurvy is due to an insufficiency of this element in the body. This cannot explain the pathology, as the administration to the patient of an abundance of potassium does not effect a cure. Ralfe believes that the primary change depends upon "a general alteration between the various acids, inorganic as well as organic, and the bases found in the blood, by which (*a*) the neutral salts, such as the chlorides, are either increased relatively at the expense of the alkaline salts; or (*b*) that these alkaline salts are absolutely decreased.

This condition produces diminution of the normal alkalinity of the blood; and he suggests that this diminution produces the same results in scurvy patients as happens in animals, when attempts are made to reduce the alkalinity of the body, namely, dissolution of the blood-corpuscles, ecchymoses and blood stains on mucous surfaces, and fatty degeneration of the muscles of the heart; the muscles, generally, and the secreting cells of the liver and kidney."

The most constant and important of the exposed lesions are those observed in the gums, which tissues are spongy, swollen, œdematous and often ulcerated. The teeth may loosen and be lost. The connective tissue, particularly of the lower extremities, is often saturated with serous exudation, which may contain blood, and considerable fibrin. Less frequently the muscles are infiltrated with fibrinous exudate, which lies between the muscular fibres and gives a striated appearance to the tissues when incised. The muscles are highly fatty, this change being first apparent in the lumbar muscles. The changes in the skin and muscles give to the lower extremities a bruised appearance and an abnormal firmness, which is more pronounced in the muscles of the posterior surface of the limbs. Similar effusions may appear beneath the periosteum, giving rise to protuberances, and in rare cases to destruction of bone. Fluid is found in some of the joints, and the synovial membrane and cartilage may be partially destroyed.

The heart is fatty, small, flabby, and its walls may contain extravasations of blood, and its cavities coagula. The pericardium may be inflamed, contain fluid, and like the endocardium be stained by imbibition.

The nervous system may or may not present alterations, the most constant being the evidences of anæmia. The ventricles may contain fluid, which is sometimes bloody, and the cerebral tissue may be infiltrated and softened.

The upper respiratory passages appear anæmic, but with spots of extravasation here and there. The lungs often manifest the appearance of hypostatic congestion in the lower lobes posteriorly, and gangrene is not uncommon. More frequently there is infiltration of these organs with bloody serum or sero-fibrinous material. The air-tubes often contain bloody froth, and the larynx may be œdematous. The pleural cavities frequently contain fluid which is often bloody.

The kidneys are occasionally hyperæmic and may contain infarctions, or be in a state of parenchymatous degeneration. The mucous surface of the genito-urinary tract is often swollen, ecchymotic, and contains bloody urine. The lower portions of the digestive tube also develop marked lesions. The mucous membrane of the stomach is softened and ulcerated, and that lining the intestines presents still more pronounced lesions. In the small intestine the solitary follicles ulcerate, and to these

glandular changes which also appear in the large intestine, there is added infiltration of the walls of the gut, also hæmorrhages into the mucous membrane in any portion of the tract.

The large glands within the abdomen, viz., the liver, spleen and pancreas, are congested, softened and ecchymotic.

The blood may have a cherry-red color and be much diminished in quantity, causing fatty changes in the tissues and anæmia.

Symptoms.—The disease is usually insidious in development, and in most instances pursues a chronic course, though when the onset is sudden the progress is rapid and pernicious. The appearance of the patient soon attracts attention by reason of the peculiar earthy, yellowish, or leaden hue of the skin, which is dry, ill-nourished and desquamates freely if rubbed. Rouppe called attention to the prominence of the skin follicles, particularly upon the extensor surface of the lower limbs, considering this an early pathognomonic sign of the scurvy. Roundish petechial spots of a reddish or brownish color appear upon the lower extremities and later upon the trunk and face. They are but a few lines in diameter and resemble the bites of some insects. The face has a puffy appearance, the conjunctivæ are pearly white; there is weakness of mind and body; the skin is cool, especially the hands and feet, and there are complaints of chilliness from slight exposure; the appetite is lost, dyspnœa appears after slight exertion, and there may be attacks of syncope; the heart is feeble, the pulse small and compressible; pains in the back and limbs resemble rheumatism, and the patient is depressed and gloomy as to the future.

In most cases the first decided lesions appear in the gums, which swell, become livid and ulcerate. The swelling and proliferation are sometimes sufficient to hide the teeth, which loosen, may become carious, and ultimately fall out. Even the bone may be involved, with consequent necrosis. Sensitiveness to contact is marked, and bleeding is easily excited. A high degree of swelling may lead to necrosis of the gums, which are changed to a blackish pulp. Portions of the gums from which the teeth have been extracted show but slight change. It is seldom that the interior of the cheeks and lips are involved. Pharyngeal inflammation, ecchymoses and ulcerations are also rare developments. These mouth and throat lesions are undoubtedly due to the friction to which these tissues are subjected during mastication. Eating is necessarily attended with considerable suffering, but at other times there is little complaint of these parts. The breath is fœtid and saliva, which may be bloody, flows freely from the mouth. The salivary glands are swollen, the tongue appears large and bears the imprints of the teeth. These lesions of the mouth have been remarkable for their absence in certain epidemics.

It is not uncommon for the changes in the gums to be followed by cicatricial developments and result in hard, callous tissue, which is permanent.

If skin lesions have not preceded those within the mouth, they are not much longer delayed. Their appearance upon the lower extremities has been referred to. The hæmorrhage begins about the hair follicles, the nutrition of the hairs being so much impaired as to cause their destruction. With time the patches lose color and finally appear as yellowish-brown spots. The escape of blood may be sufficient to elevate the skin into a papule. Less frequently it finds its way external to the rete, elevating the epidermis and forming a vesicle, which may rupture and become covered with a bloody crust or present an ulcerating and discharging base. These ulcers manifest little tendency to heal. If beneath the nails the latter may be lost. The extent of hæmorrhage into the subcutaneous tissue may be large, involving a considerable portion of a limb. The temperature of the surface over the hæmorrhagic area is elevated, the part is tender, has a doughy feel and is painful in proportion to the rapidity of the accumulation. These extensive hæmorrhages are most frequent in the regions of the large tendons, viz., the hamstrings and tendo-Achillis. Like the mouth changes, they may be followed by sclerotic ones, which, through connection with the subjacent tissues, may impair the functional activity of the parts through diminution of mobility or atrophy of the muscles. If the hæmorrhage is large, inducing much pressure, or independently of this factor, inflammatory changes may develop, resulting in suppuration, with discharge of dark offensive matter and the formation of large, foul ulcerations. Hæmorrhages into the deep parts are followed by results of the same general character, viz., suppuration, excavation, deep-seated ulcers and even gangrene.

Bleedings from the free surface of the skin or from any of the mucous membranes are less frequent hæmorrhagic manifestations of scurvy, but may be of sufficient gravity to prove fatal. Hæmorrhage into the serous cavities occurs rarely and may excite inflammation. The pleura and pericardium are most frequently involved. The size of some of these cavities permits a sufficiently free discharge to cause alarming symptoms from loss of blood or compression of the lungs or heart. If from the meninges, hæmorrhages may give rise to apoplectiform attacks, pain, paralysis, contractures, etc.

In outbreaks of exceptional severity, subperiosteal effusions cause hard and painful nodes, especially upon the tibia, although many bones may be involved. It is not rare at such times for the epiphyses to be separated from the shafts of the long bones, or for the costal cartilages to be separated from the ribs.

The articulations may be implicated, being swollen, painful, and in some cases suppurating, with consequent destructive changes in the articular surfaces and ultimate ankylosis. Fractures which have undergone recent repair may recur, and hæmorrhage, fibrinous exudate and

various features of the disease are especially liable to develop in the region of wounds and injuries.

Eye changes in the form of hæmorrhages into the conjunctiva, anterior chamber, or deeper parts, with subsequent inflammation, are not uncommon. A double keratitis, with sequential panophthalmitis similar to that resulting from disease of the trigeminus, has been repeatedly observed. Hemeralopia is not an unusual prodrome.

The heart is feeble from the early stage, its pulsations being reduced in frequency and force, often disturbed in rhythm, and a systolic murmur of anæmic origin is common. It may present anæmic dilatation. The bloodvessels are diminished in calibre, and the pulse is soft and small, and venous murmurs appear. The anæmia and alterations in the composition of the blood lead to impairment of the nutrition of the capillaries, which favors hæmorrhages and is a further cause of impaired nutrition. Embolism of the lungs and spleen may occur, with resulting infarctions, and sometimes sudden death, even in cases apparently doing well.

With progress of the disease the strength gradually diminishes, the adipose disappears and the muscles atrophy; but in some instances the general nutrition is but slowly impaired, the patient retaining a plump appearance and considerable strength for an unusual period of time.

The temperature is reduced in the course of cases free from complications, often to 96°, 94° or 92° F. Elevations of temperature are due to involvement of internal organs, abscess, etc.

Diarrhœa, tending to assume a dysenteric character, is a frequent feature, and it is supposed that scurvy favors the development of true dysentery. Urinary changes are of slight significance, except in rare cases. The urine may be albuminous, but nephritis is rare. The urea is generally diminished.

Diagnosis.—Difficulty in diagnosis can hardly arise except in isolated cases, which are met with great rarity. In general, the circumstances under which the disease has developed will prove sufficient to at once direct attention to the true nature of the case. A history of a lack of fresh vegetables in the patient's dietary, with exposure to cold and damp, hard work and unfavorable mental influences, in connection with the peculiar appearance, a high degree of debility, spongy gums, petechiæ and a bruised-like condition of the lower extremities, are the most important diagnostic data. The resemblance to mercurial stomatitis might, in isolated cases, suggest such poisoning, but while the symptoms of the mouth are similar, the entire "setting" of this symptom in scurvy differs from that due to mercurial poisoning. The resemblance of purpura to scurvy is stronger, for in scurvy the hæmorrhagic spots may sometimes be limited to the lower extremities and unattended by lesions of the deeper tissues or by hæmorrhages from the mucous surfaces in any but serious cases of this disease. The importance in all instances of the history of the case must not be overlooked.

Prognosis.—Uncomplicated scurvy warrants a favorable prognosis, as nearly all cases respond promptly to proper treatment. The possibility of embolism, infarctions, or failure of the circulation, in cases which do not give other evidences of gravity, cannot be overlooked, as death occurs rarely from such causes. Involvement of internal organs, or bones and joints, add greatly to the seriousness of the condition. Syphilis, dysentery, malarial fevers, and anæmia from any cause, are the more important conditions liable to be associated with scurvy and to determine an unfavorable course of the disease. The duration of scurvy is governed largely by the time of establishment of proper treatment, which, within a few days, gives results of a surprising character.

Treatment.—*Prophylaxis.* This consists in securing to the individual a regular supply of those articles, an absence of which from the dietary has been found to cause the disease. Our merchant and naval marines have learned the best method of feeding crews for the prevention of scurvy, which, in connection with personal and habitation cleanliness, good ventilation, and avoidance of too great exposure to cold, wet, and depressing emotions, has nearly stamped out the disease. The most valuable articles of anti-scorbutic food are fresh vegetables, especially potatoes, onions and sauerkraut, also fruits, such as oranges and lemons. The latter possess especial value and may be given freely, *i. e.*, in quantities of several ounces of the juice, well diluted with water, in the course of each day. The value of lime juice as an anti-scorbutic has long been known, and it is now served to all crews subsisting upon a diet of salt food; indeed, this is required by law. It is easily preserved by the addition of alcohol, or may be reduced to a paste by evaporation, thus greatly concentrating it.

After the establishment of the disease the same character of diet is demanded, especially the free use of lemon or lime juice, and of fresh vegetables if procurable; also fresh meats of all kinds may be given as the patient's condition will permit, and as the appetite is often good, these articles are freely used. Milk is admirable and, with beef tea, fresh chopped or scraped meat, may be given when the stomach is sensitive.

The mouth should be washed frequently with pure water or a weak solution of permanganate of potash or boric acid, and any external ulcerations treated with simple antiseptic solutions.

Medicines occupy a subordinate position, but are of value in cases which do not respond promptly to dietetic and general measures.

Mercurius assists in the control of the symptoms, especially those related to the alimentary tract, viz., ulcerated gums, salivation, swollen glands, fœtid breath, puffy tongue, tender epigastrium and dysenteric symptoms. It also corresponds to the debility of body and mind and the wretched appearance.

The mineral acids are of decided value; *muriatic acid* when the

general muscular debility is extreme, the heart feeble, the pulse small, compressible and intermitting; the patient sinks to the foot of the bed a helpless mass; the muscular system being much involved in these cases. *Nitric acid* is better suited to cases with extensive ulceration of the gums or of other parts, while *sulphuric acid* is called for when hæmorrhage is the prominent symptom. Hæmorrhagic cases suggest *phosphorus* when the individual is of the phosphorus character; *hamamelis* when the flow is profuse, dark and general, *i. e.*, from any or many points, while *terebinthina* is more especially useful for the hæmaturia. *Crotalus* should be useful, also *cinchona*, especially for the consequences of the loss of blood.

Lachesis and *arsenicum* will of course be considered for the ulcerations, especially if they are unhealthy or gangrenous.

During convalescence, and even during the active stage, I have found *ferrum phosphoricum* of apparent value. It seems to be well adapted to the blood changes and also to the respiratory symptoms which sometimes arise.

Aside from these remedies, *ammonium carb.*, *cantharis*, *carbo veg.*, *cistus can.*, *hydrastis*, *creasote*, *natrum mur.*, *nux vom.*, *phosphoric acid*, *staphisagria*, *sulphur*, etc., have been employed with benefit.

LITHÆMIA.

Synonyms.—Lithuria; lithic acid diathesis; the arthritic diathesis.

Definition.—The term lithæmia was introduced by Murchison to represent certain symptoms which he believed to be due to functional disorder of the liver, but which we now regard as indicative of the arthritic diathesis, and dependent (in great measure) upon the presence of an excess of uric acid in the system.

Etiology and Pathology.—This condition may be hereditary or acquired. The prominence of uric acid in its etiology requires an investigation into the origin, location and manner of elimination of this substance, particularly the latter, as it seems probable that we have to deal with defective elimination rather than with an excessive development. It is, in all probability, the product of metabolism of the proteids of the body, and closely allied to urea, representing this substance in the urinary secretion of birds and reptiles. Sir William Roberts considers it a vestigial remnant. It has been considered as a substance which in a higher degree of oxidation would result in urea, but many physiologists now look upon it as a separate and distinct product of tissue change. The theory that uric acid originates in the liver does not appear to be well supported, as this organ contains but a trivial amount, and the blood in the hepatic vein contains no more than that which is conveyed to the liver by the portal vein. It is found in considerable quantity in the spleen, and as the return blood from this gland must enter the liver, it would seem to explain the amount of uric

acid emerging from the latter organ. According to Minkowski it is formed in the liver by the union of lactic acid and ammonia. The kidneys have also been supposed to possess a relation to the origin of this substance, Garrod contending that it is formed in these organs, but we also lack positive data upon this point. It is probable that uric acid, like pigment and other constituents of the urine, is separated from the blood by reason of the selective power of the epithelial cells lining the tubules, unlike the watery solution of the salines, which pass through the glomeruli more or less freely according to the degree of tension of the renal vessels.

The present trend of opinion is in favor of the view that uric acid is formed within the tissues, and that it is simply eliminated by the kidneys.

A fact of great importance which has but lately been established, is the influence of the alkalinity of the blood in preserving uric acid in solution. Haig's valuable observations relative to this subject show that the amount of uric acid eliminated in the urine is increased or diminished by increasing or decreasing the alkalinity of the circulating fluid. The increase which follows for a day or two upon the free administration of alkalies, such as salicylate of sodium, is supposed to have its origin in the uric acid, which is stored in various organs. It is found to have undergone increase in the blood during the same period. In commenting upon solvents of uric acid, this observer further observes that lithia, which proves such an effectual solvent of this substance, externally to the body, is without influence when taken for this purpose, as it at once forms with the phosphate of soda in the blood an insoluble compound, which not only exerts no influence upon uric acid, but removes from the blood a valuable solvent of that substance. A protracted diminution in the alkalinity of the blood results in diminished excretion of uric acid and the development of the symptoms of uric-acidæmia. It is this retained irritant which, acting upon the joints, causes gouty inflammation, and upon the arteries, high tension, headache, vertigo, mental disturbance, etc., and later, cardiac hypertrophy.

Symptoms.—Undoubtedly the influence of uric acid poisoning is exaggerated in certain directions, but in the present uncertain state of its pathology we are unable to rigidly draw the line between those conditions which are clearly due to this cause and others of uncertain origin. It is even asserted, by excellent authorities, that uric acid may be only one of several substances—and not the most important one—giving rise to these symptoms.

Many of the nutritional disturbances, apparently excited by uric acid, are marked by impaired oxidation of tissue, notably gout. The digestion is impaired in various directions, catarrhal inflammation of both the gastro-intestinal and respiratory mucous membranes is com-

mon. Irritation of the nervous tissue results in many irritative symptoms. Neuralgias, mental depression, irritability of temper, insomnia, and headache, often of a congestive type, are prominent. A variety of skin lesions, including urticaria and eczema, are clearly the result of this cause, also biliary, and especially renal calculi. The frequent dependence of interstitial nephritis upon this cause is well established, also acute catarrhs of the genito-urinary mucous membrane. I am satisfied that it is a prominent excitant of chronic urethral disease, having its acute development in gonorrhœa.

As seen in the urine, most of the uric acid is in combination with sodium and ammonium, constituting the "acid urates." If separated from the bases it appears in the typical crystalline forms resembling grains of Cayenne pepper, which have been already fully described (p. 338). The separation is due to an excessive amount of uric acid, an abnormally high degree of acidity, and abnormally little of pigment and mineral salts (Roberts). For a further consideration of this subject, especially for its treatment, see "Gout," page 888.

It may be added that *lycopodium, sepia, sulphur, berberis* and *thlaspi bursa pastoris* have been most strongly recommended as useful for the lithæmic state. When associated with gouty arthritis *colchicine* is of first importance.

RICKETS (Rachitis).

Definition.—A general affection of nutrition to which infants and young children are subject, and which is excited by improper feeding and a want of fresh air, sunlight, cleanliness, etc. It is characterized by impairment of the general health, arrested growth, abnormal proliferation and delayed calcification of the developing bones.

Etiology.—The cause of rickets is not positively known, but we have very certain knowledge of the conditions under which the disease develops. These are suggested by the statement that nearly all cases occur among the offspring of the poor in crowded portions of the great cities of the temperate zone. It is more common in the cities of England and on the continent than in America. I have been struck by the small number of cases coming for treatment at the clinics in Philadelphia, and the few applying for the treatment of other ailments, who are discovered to be rachitic, the number being in marked contrast to that observed in the European capitals, which varies from 50 to 75 per cent. of all children applying for treatment. It can only be explained by our admirable housing of the poor. Colored children exhibit a marked predisposition to the disease. Of first importance appears to be the character of the diet of the little patient. This has usually been of an improper nature, of poor quality, and often insufficient in quantity. Too much of starch, poor cows' milk, or this article improp-

erly prepared, the use of patent foods, irregular feeding, unhealthy mother's milk, especially nursing during pregnancy, or prolonged lactation, are some of the causes of disordered digestion and assimilation upon which this disease depends. Of hardly secondary importance is a lack of light and well-ventilated apartments, and a failure to take the child frequently into the open air. Heredity has been advocated, but does not appear to be supported, although the evidence of inheritance of an impaired constitution is often strong. The parents are often syphilitic, the mother especially anæmic or tuberculous; but these factors probably act only by creating a greater delicacy of nutrition, consequently, a child which is vulnerable. Parents who are advanced in years, or mothers who have had frequent pregnancies, are thought to be more apt to have rachitic children. A small percentage of cases develop in children of healthy parents, but these may often be explained by the character of the diet. Few cases develop before the sixth month or after the third year, and with great rarity after the fifth or sixth year.

Morbid Anatomy.—The characteristic lesions of rachitis are found in the bones, particularly in the extremities of the long bones, in the bones of cranium, and in the ribs. It is well to recall the following facts relating to the growth of bone. Development of the long bones proceeds from the periosteum without, the medullary space within, and the cartilaginous extremity—the epiphysis, the junction of which with the shaft is indicated by a chondroid substance divided into two narrow bands, which, as far as the extremity of the bone is concerned, is the area of active multiplication of cartilage cells and their transformation into bone.

According to Kassowitz, hyperæmia involving all of the structures entering into the composition of bone, viz., periosteum, osseous tissue, cartilage and marrow, is the initial change in the development of rachitic lesions, and tends to an exaggerated proliferation of cartilage cells and a gradual softening of the matrix. Calcification is retarded and irregular, the resulting structure being soft, yielding gradually under normal use with resulting deformities, which will be considered when discussing the symptoms. Growth is retarded in the long bones. It is more marked in the epiphyses, which may be considerably enlarged. The subperiosteal strata are spongy and manifest thickening and cellular proliferation with ultimate transformation into osseous tissue. As in the extremities, calcification proceeds irregularly, involving numerous points, which gradually increase in size and coalesce with the formation of a shaft which is of greater diameter than normal.

It is probable that the hyperæmia stimulates absorption sufficiently to cause removal of earthy salts from bone already well developed, and this is supposed to take place especially on the side of the medullary canal; though this not admitted by all authorities. Microscopical exam-

ination of spongy tissue shows the jelly-like contents of the spaces to consist of cell elements of various shapes and blood-corpuscles. Its relation to cartilage or bone cannot be stated positively.

Rachitic bones, particularly thin ones, as those composing the cranium, may undergo sufficient softening to permit incising them with a knife. Longitudinal section of a long bone exhibits marked thickening, vascularity, and a slightly bluish color of the stratum of cartilage, which is interposed between the epiphysis and diaphysis and which may be visible upon the external surface of the bone as an elevated band, with less consistency than the neighboring surfaces. The changes taking place in the flat bones are best studied in those of the cranium, which become much thickened, especially at their edges, resulting in prominence of the sutures when ossification is completed. The fontanelles may remain open well into the third year. Portions of the cranium, especially the occipital bone, undergo a marked degree of absorption and thinning under the stimulus of the internal pressure produced by the rapidly developing brain of the young child. This thinning is also favored by the imperfect calcification. The condition may be readily detected by palpation.

The weight of the bones is much diminished in rachitis. Trousseau found those of a child eight years of age to weigh but about one-seventh the normal, and chemical examination reveals a loss of two-thirds of the inorganic elements. With recovery the deposit of these elements is excessive, and without the normal process of ossification, which leads to the formation of a structure of great density. This condition is more pronounced in the epiphyses and in great degree arrests the growth of the bone in its long axis. F. W. Beneke has carefully studied the blood-vessels of rachitic children and asserts that the arteries are of abnormal size throughout the body, particularly the carotid vessels, to which he thinks the changes in the head mainly due. In several cases terminating rapidly these vessels were unusually capacious. To this abnormal capacity he attributes the increased vascularity and impaired circulation, which is especially prominent in the epiphyses, also the inflammatory pulmonary complications, etc.

Symptoms.—There is considerable variety in the onset of the disease, many cases are preceded by disturbed health, more particularly by gastro-enteric disorders with loss of appetite, eructations, vomiting, distention of the abdomen, diarrhœa with acid or foul stools, and a sour-smelling breath. There may also be the general evidences of impaired health, viz., paleness, flabbiness, unhealthy skin, emaciation or undue fatness. Less frequently the lesions appear after trivial disturbance of health, and perhaps after the child has learned to walk.

It is first noticed that walking tires, and that there is a disposition to lie down and keep still; slight fever appears at night, the bed-cloth-

ing is kicked off, and the head sweats profusely, especially during sleep. When handled the child may cry, or complain if old enough, due to a general tenderness of the body, which is more marked in the extremities. Whatever the early condition of general health may be, with the active development of rickets the child becomes feeble, loses flesh, and the symptoms already detailed increase. The lesions may involve most or all of the bones; less frequently those of the lower extremities manifest the first changes with extension to those of the upper extremities, trunk, and finally, to the cranium. The changes are less marked in the bones last attacked. In cases of this character the susceptibility of the patient is evidently not as great as in children developing the general form, for it seldom appears before eighteen months or two years of age.

The symptoms related to the thorax are among the first to appear, especially the development of nodules which may be readily palpated, and often seen in thin children, at the junction of the ribs with the cartilages. They are rarely met in subjects over five or six years of age, are due to proliferation of the cartilage elements, and identical in pathological character with the changes in the epiphyses. The yielding character of the thoracic walls favors the characteristic deformity developing in these structures, which persist as the most prominent sequence of rickets. It is due to pressure, not to muscular action.

The more important features of this deformity are vertical grooves, external to the junction of the ribs and cartilages, which gradually diverge from the median line in their downward course. The sternum is rendered prominent ("chicken-breast"). These grooves are crossed by depressions which extend from the region of the lower extremity of the sternum toward the axillæ. The latter are usually more pronounced during inspiratory efforts. These parietal changes exercise a most unfavorable influence over the development of the lungs, and the heart is displaced to the right or is elevated. Organic changes, especially hypertrophy, may develop. Acute pulmonary diseases are attended by unusual danger as the result of impaired activity of the respiratory organs.

Deformity of the extremities is due to enlargement of the epiphyses, and curving and twisting of the shafts of the long bones. The epiphyseal changes are more pronounced in the lower extremities of the bones of the leg and forearm, the enlargement of these parts being conspicuous. Deformity is due to the weight of the body, muscular action, and pressure. The form of distortion of the bones of the lower extremities is dependent mainly upon whether the child has learned to walk or not. If it has, the curves will consist in an increase of those which are normal, *i. e.*, the convexities will be from the median line, giving rise to "bow-legs," and "knock-knees." Deformities of the feet are common. These various distortions of the lower limbs are the cause of awkward and often difficult locomotion. Bowing in other directions is infre-

quent. The radius and ulna are less often bent and in much less degree. Their curve is usually to the extensor aspect of the limb. The femur and humerus are less frequently bowed and seldom in marked degree. The epiphyses, especially of the lower extremities of the femur and tibia, may be displaced, not preserving their relation to the long axis of the bones. Fractures, usually of the incomplete variety, are not uncommon.

The head is apparently enlarged, due to continued growth of the brain, that of the bones of the face being arrested. The long diameter may be positively increased, but the face appears diminutive, indeed the growth of the facial bones is inhibited. The fontanelles and sutures do not close, and the margins of the bones are thickened. Hyperplastic changes progress in the frontal and parietal elevations, with resulting thickening of these bones, while portions of the skull, particularly the occipital bone, are thinned and, when palpated, crackle like parchment (cranio-tabes). Numerous spots may be discovered, especially upon the back of the head, where the osseous matter has entirely disappeared. The forehead is broad, flat, and has a squarish outline. The skull, also, often has a quadrilateral form—the "*caput quadratum.*" The hair upon the back of the head may be lost as the result of the impaired nutrition of these parts, caused by tissue changes, continued pressure during recumbency and excessive sweating. A systolic murmur heard with greatest distinctness over the anterior fontanelle has been held to be characteristic of the rachitic skull. This has been disproven, however, the murmur being not uncommon in healthy subjects. Juracz considers it due to stenosis of the carotid arteries, which are temporarily retarded in development, and that it is only heard in association with a coincident murmur in these vessels.

The inferior maxillary bone undergoes changes which are, in a measure, at least, the result of muscular action exerted upon the softened structure. The anterior portion undergoes flattening, developing abnormal angles, the general effect being that of squareness. The upper surface of the jaw is directed abnormally inward and posteriorly, with a resulting malposition of the teeth, which are delayed in their appearance, irregular in development, abnormal in size, deficient in enamel, and the anterior surfaces of the incisors are roughened or ridged from loss of enamel. The superior maxillary bone is diminished in its transverse diameter. The roof of the mouth is narrow and abnormally high.

Feebleness of the soft tissues leads to an exaggeration of the posterior convexity of the spine, sufficient, in some cases, to resemble Pott's disease. The parts are at once restored to their normal position if the child is laid upon its back. Curves in other directions are much less common.

Pelvic deformity is common and is the result of compression of the pelvic bones between the thigh bones upon the lower side and the weight

of the parts above. The sacrum is displaced forward and downward, reducing the conjugate axis. The lateral walls may be approximated by the pressure of the heads of the thigh bones, causing abnormal prominence of the symphisis pubis. Lateral curvature of the spine, as well as other factors, may distribute the pressure in such a manner as to modify the deformity. In female subjects the influence of pelvic distortion is felt when the period of child-bearing arrives, labor being seriously complicated or impossible.

The fœtus may exhibit many of the evidences of rickets (congenital rachitis). There is excessive bowing, and sometimes fracture of the limbs, which are short. The fontanelles are abnormally large, and there is an absence of the proliferating cartilaginous segment interposed, between the epiphyses and the shafts of the long bones.

Rickets is a chronic affection lasting for months. Acute cases have been reported, but these possess rather the character of scurvy or osteomyelitis.

Nervous symptoms are often a prominent feature of rickets. Irritability, sleeplessness, twitching of muscles and starting of the entire body are common. Convulsions may occur, and, according to Sir William Jenner, rachitis is closely related to those which occur later than the sixth month. The muscles of the larynx are irritable, and there is a predisposition to the various affections marked by laryngeal spasm, viz., laryngismus stridulus, spasmodic croup, etc. Tetany may occur and involves the upper extremities most frequently. Mental development is often very rapid.

Complications.—Bronchitis is frequent and persistent, with a strong tendency to the development of broncho-pneumonia. Emphysema is occasionally observed, also scrofula, tuberculosis, chronic hydrocephalus, convulsions, tetany and spasmodic affections of the larynx.

Diagnosis.—Difficulty in diagnosis can only occur when the rachitic condition is ill-developed. It is suggested by the prominent symptoms which have been detailed, viz., general evidences of malnutrition (although the child may be plump), with profuse sweating of the head, slight night fever, causing the bed-clothing to be kicked off, delayed eruption of the teeth, tenderness, especially of the lower extremities, with indisposition to stand or make use of the lower limbs. If carefully examined at this time, the wrists and ankles may be found enlarged and tender. The joints may be loose, diarrhœa is often troublesome, and, if the teeth have appeared, the incisors may be ridged. Scurvy may complicate or simulate rachitis. In scurvy there is marked tenderness and often the slightest movement of the lower extremities causes screaming and every evidence of intense suffering. In uncomplicated scurvy there is an absence of any degree of enlargement of the extremities of the long bones, of sweating of the head, night fever, etc.

Prognosis.—The danger to life is from intercurrent developments such as acute bronchitis, broncho-pneumonia, convulsions, etc., or more chronic processes such as scrofula or phthisis. Rachitic children are particularly prone to bronchitis, a combination resulting in a high degree of mortality. A very few die from general failure arising from the prostrating influence of the disease. The future of the child depends much upon the condition of the chest walls. Marked distortion of the ribs with a high degree of recession of the lower portion of the chest during inspiratory efforts is most unfavorable, also extensive involvement of the glandular system.

If the course of the case is favorable the symptoms diminish in severity; first the more general ones such as fever, gastro-intestinal troubles, and sweating, followed by diminution in size of the enlarged epiphyses. Even the curved bones straighten somewhat, ossification progresses, the bones lose their softness and become strong, although often abnormally thick. The retardation of growth may continue for a sufficient period of time to result in a permanently small stature.

Treatment.—The first step in the treatment of rickets is to improve the unfavorable conditions under which the disease has developed. To accomplish this it is necessary to order that the child shall be properly housed, fed, bathed, aired, etc. As to apartments, they should be dry, light, properly warmed and well ventilated. When the weather permits, it is important to take the child into the open air, and it is best to persist in this daily airing even during cool weather, using every precaution to avoid taking cold. Bathing should be repeated daily. The clothing should be light, consisting preferably of flannel. The bed should be composed of some firm material, and the pillow of hair. High pillows are objectionable. Deformities are favored by walking and by too long continuance of certain positions. The food should be the milk of a healthy mother. Too protracted nursing has been mentioned as favoring rickets. If this source of food is impossible, sterilized cow's milk should be selected and properly diluted, according to the age of the child. Most children do well upon mixed milk if it has been properly cared for, and there is less risk than from the milk of one cow unless the latter is known to be a healthy young animal. The formation of curds of too great density may be prevented by adding a quantity of long-cooked and well-strained oat-meal, barley-meal, or other similar article. Patent foods should be avoided. As the digestive organs are often at fault, it is impossible to give specific directions as to diet within so limited a space. The problem is to discover a character of diet which will digest readily, and this must be learned largely through careful inspection of the stools. If a scorbutic taint can be detected rapid improvement may follow the giving of anti-scorbutic food. After weaning, milk should still be used, and animal food in other forms added to the dietary, especially animal

broths, scraped beef, and gelatin. Stale bread, or better, a plain bread pudding with butter, is usually relished. Fats, in the form of whipped cream, butter, and cod-liver oil, are well taken and beneficial.

Of medicines for this condition the most important are *phosphorus* and the same drug in its various combinations, especially *ferrum phosphoricum* and *calcarea phosphorica*. It is well to begin the treatment with remedies addressed to the symptoms of gastro-intestinal disturbance, or any other acute group of symptoms which may be present, and after relief of these to administer phosphorus if not contra-indicated. It is best to begin with the third to the sixth dilution, and employ lower preparations if required. Fresh dilutions made from a saturated solution of phosphorus in alcohol are advisable. Should intercurrent remedies be required phosphorus may be omitted for the time. The chronic character of the disease and the necessity of infrequent changes in the essential remedy should be remembered.

Ferrum phosphoricum appears to be nearly as valuable as phosphorus as an essential remedy for rachitis. I have found it more efficient when the limbs were tender and motion excited pain—symptoms suggesting scorbutus—and for the bronchitis and broncho-pneumonia. The combination with lime—*calcarea phosphorica*—is preferable when the calcarea constitution is well developed. The second and third decimal triturations of these preparations I have employed most frequently. *Calcarea carbonica* often relieves the sweating and gastro-intestinal symptoms with sour stools, but is not as valuable an anti-rachitic remedy as *silicea*, which Hughes first strongly recommended for the control of the sweats, sensitiveness of the surface, and cartilaginous changes. *Phosphoric acid*, long ago recommended by Hartmann, is a remedy of power for feeble children who seem to be greatly exhausted. They lie much in one position and are disinclined to move, and have loose stools with considerable flatulency. The lower dilutions act favorably not only upon the debility and diarrhœa, but upon the changes in the bones.

The symptoms attendant upon disordered dentition, the various laryngeal, bronchial, pulmonary and gastro-intestinal complications are to be treated as if independent affections.

Aside from the remedies recommended, *asafœtida*, *baryta carb.*, *belladonna*, *fluoric acid*, *lycopodium*, *ruta*, *rhus tox.*, *staphisagria*, *theridion* and *sulphur* may prove of service.

Skilful application of orthopædic apparatus may improve deformity. Failing in this the distorted bones may be straightened by means of surgical operations.

OSTEOMALACIA.

Synonyms.—Mollities ossium; malacosteon.

Definition.—A rare affection, characterized clinically by softening, distortion and even fracture of the bones, the result of their decalcification. Unlike rickets, it affects adults almost exclusively.

Etiology.—Osteomalacia is one of the rarest of diseases, less than two hundred cases having been recorded. Its cause is not known. Few cases have been observed in persons under twenty or after fifty years of age. Women furnish at least nine of each ten cases. It is extremely rare in children, in fact, some authors do not admit its occurrence in this class. It has prevailed in certain regions. Casati claims that in Milan nearly one per cent. of all puerperal women developed osteomalacia, most of the patients coming from a certain valley. In 50 per cent. of all cases the development is in association with pregnancy or lactation, especially rapidly repeated pregnancies and prolonged lactation. Quite a number of the remaining cases are related to senility, and the development of all forms is favored by poverty and its attending conditions.

Pathology and Anatomical Alterations.—Gradual decalcification results in a high degree of softening of the bones, which, when the change is well developed, may be readily cut with a knife, and being unable to support the superimposed weight they undergo distortion and may fracture. Section reveals an enlargement of the medullary canal. There may be a general or localized absorption of the spongy portion, the space or spaces being filled with the increased medullary substance, which in advanced stages becomes fatty, then atrophic. The bone canals also enlarge and are filled with soft, reddish tissue. This enlargement of the medullary cavity and normal canals within the bone, associated with progressive decalcification and atrophy of the osseous tissue from within outward, with corresponding weakening of the structure, bending or fracture are the characteristic anatomical changes. It is believed that a thin sub-periosteal stratum of osseous substance always remains. The periosteum undergoes thickening and the proliferating layer is hyperæmic. During active progress of the disease the medullary substance is highly vascular, and it, as well as the deeper layer of the periosteum, may contain hæmorrhagic extravasations. Microscopical examinations show the medullary spaces to be filled with nucleated medullary cells, and the adjacent osseous structure, losing its lime salts, appears fibrillated, and contains unbranched remains of bone corpuscles. The prevailing theory as to the pathology of osteomalacia attributes the solution and removal of the lime salts to the presence of lactic acid. The excessive amount of this substance which tends to store in the bones, is the result of impaired oxidation. According to Rindfleisch, carbonic acid may possess a solvent power, it also accumulating in the bones as the result

of impaired oxidation. During pregnancy the fœtus is supplied with lime at the expense of the mother, who does not retain sufficient for the wants of her organism. Why this is so has not yet been explained. The relationship existing between osteomalacia and diabetes is an interesting one, as they seem sometimes to be transmuted one into the other, according to the conditions under which the patient lives; for instance, the osteomalacia may be exchanged for diabetes, when the poverty-stricken individual is better surrounded and well fed.

Symptoms.—The onset is usually very gradual. The most important early manifestation is pain, usually continuous, and appearing in that portion of the body first attacked, which may be the pelvis, spine or ribs. It is of a rheumatoid character, deep-seated, aggravated at night, after protracted exercise or long sitting or stooping, and may be associated with tenderness. Fever is an occasional attendant.

After a continuation of this pain for a variable time, another of the early symptoms, viz., deformity, appears. If the pelvis is attacked, the acetabula are approximated and the sacrum pressed forward into the pelvic cavity. The result is encroachment upon the superior and inferior straits, resulting in interference with labor, and, in some cases, with the functions of the bladder and rectum.

Involvement of the ribs results in deformity due to bending and fracture. The latter presents some uniformity in development; a series of fractures—due to external pressure—occurring in the line of the axillæ, while other rows of fractures posteriorly and anteriorly to these lines may result from muscular action and various movements. The sternum also yields and may fracture. The changes in the parietes of the chest disturb the contained organs; as a consequence dyspnœa, asthmatic paroxysms and palpitation of the heart are common symptoms. Lateral curvature of the spine is not rare, exaggeration of the normal spinal curves is common, especially the cervical, throwing the head forward and downward in a marked fashion. The softened vertebræ yield under their burden with corresponding shortening of the stature. The extremities may become fragile and fracture from trivial accidents, such a fracture sometimes being the first evidence of the existence of the disease. Callus is imperfectly formed or may be absorbed after its formation. Excessive curves of the bones of the lower extremities may lead to difficult and awkward locomotion. The bones of the cranium are but rarely involved, although the teeth have decayed rapidly or fallen out. The muscular system is illy-nourished, flabby and irritable, indicated by twitchings and contractures, which may be excited by superficial irritants.

The urine does not present anything characteristic. Excretion of lime salts is not regularly increased. They may be present in the urinary sediment or as calculi within the kidneys. Urea and uric acid are about normal. Albumin is rarely present.

The milk, sweat, salivary secretion, also that of both the respiratory and gastro-intestinal mucous membranes, contain calcareous salts in considerable amount.

The duration of osteomalacia may be from one year, or somewhat less, to ten or more years. During this protracted course there are many fluctuations. Aggravation is quite certain to occur, should pregnancy take place, and intercurrent disease may give an impetus to the process. Nearly all cases terminate fatally, either from progressive general failure or from affections within the thorax, excited by the changes in the chest walls.

Diagnosis.—Uncertainty as to the nature of the affection can only exist before the occurrence of the characteristic deformities. The early pains will at first suggest a variety of diseases, especially rheumatism or neuralgia, but their localization and course, and the character of the patient, are strongly indicative of the nature of the disease. The deformities resemble those of rachitis but are of higher degree. The latter affection is confined to infants, the former almost entirely to adults. Rachitis is also attended by swelling of the ends of the long bones, peculiar button-like enlargements upon the ribs, sweating of the head, etc.

Prognosis.—This is highly unfavorable, as cases rarely recover. Too much hope must not be based upon improvements, which are sooner or later followed by aggravation. Pregnancy more than any other influence accelerates the disease.

Treatment.—Every effort should be made to improve the patient's surroundings in order to secure a suitable habitation, an abundance of fresh air, good food, and suitable clothing. In order to improve oxidation the patient should remain much in the open air and take what exercise seems prudent. If unable to exercise, systematic gentle massage and frictions should be continued regularly. Foods rich in the salts which are required for the nutrition of the bony tissue should be freely employed. Women should avoid pregnancy, and nursing women should wean their babies at once.

The most successful results thus far attained have followed removal of the ovaries, or of the ovaries and uterus.

I can discover but little recorded therapeutic experience.

The old school has now popularized our long-ago suggestion of *phosphorus*. *Calcarea* and *iodine* were employed by Arnold.

The suggestions offered for the treatment of rachitis should be consulted.

Arnica, calcarea phos., fluoric acid, picric acid, silicia and *symph.*, have been recommended.

OBESITY (Polysarcia).

Definition.—An abnormal accumulation of fat in the regions where the substance normally exists, viz., the subcutaneous, intermuscular, and subserous connective tissue; also in the mediastinum, upon the pericardium, about the kidneys, and in the omentum. The distribution of the fat is usually uneven, some regions containing little, others a great excess.

Etiology.—First noting conditions which predispose to obesity, heredity must be mentioned as exercising the most important influence, about 50 per cent. of all fat people having had corpulent ancestors. It seems probable that the cells inherit an impaired power of oxidation. There appears to be a relationship between obesity and the arthritic diathesis, as obesity and the various forms of development of arthriticism are often coexistent in the same family and may often be traced through several generations. Age is of hardly less importance, most cases developing about the fortieth year. It appears rather later in women (after the menopause), who are less frequently affected than men, in the ratio of two to one. But few cases develop in childhood and early adult life. It may be congenital. Occupations which limit exercise, and consequently favor sedentary habits, are powerfully predisposing. Habits of this character are apt to be associated with excessive eating. Racial predisposition exists, obesity being common in some African tribes and among the Hindoos and South Sea Islanders. Climate is also a factor, as residents of high altitudes are seldom corpulent, while it is common among residents of low damp countries. This is the reason ascribed for the fatness of the Dutch, although their habits also have much to do with it. Of exciting causes of obesity excessive eating is of first importance, but while the ingestion of large amounts of food tends to the increase of adipose tissue it must apparently act in conjunction with other factors, in most instances at least, as we observe a great number of persons who eat excessively who yet remain lean or are but moderately increased in size, while at least one half of all fat people eat with moderation or even scantily. Starches and sugars are the foods which are most influential in the production of fat, but where the predisposition is strong, the character of the food taken appears to affect the result but little. The same statement applies to the use of fluids as drink, of which obese persons partake freely. Alcoholics, particularly beer, favor fatty accumulation. Their action is not fully understood. Their influence in retarding oxidation is thought to be their most important manner of action. Most persons do not increase in fat from this cause however, even if alcoholics are taken in very large quantities.

A relation between the sexual organs and accumulation of fat is shown by its occurrence after removal of the ovaries or testicles. It is

often observed in association with disorders of the generative system in women, especially amenorrhœa or sterility. Frequent moderate loss of blood as in metrorrhagia favors obesity by reason of reduction in the number of oxygen-carriers and consequent diminished oxidation.

The same reason (lessening of red blood-corpuscles) applies to the obesity attendant upon various affections characterized by anæmia, viz., chlorosis, the various anæmias, and occasionally from some destructive disease such as pulmonary phthisis or carcinoma.

A variety of affections of the nervous system favor obesity. It is common among idiots, and is often observed in sufferers from neuralgia, which is in a measure at least due to the enforced quiet often necessary. Hysterical women tend to grow fat. Convalescents from acute disease often gain much fat, also women after parturition, particularly if they do not nurse their babies.

Pathology and Morbid Anatomy.—Food is divisible into albuminoids, carbohydrates, fats, water and salts. The tissues are supplied with fat largely from the albuminous constituent, which through oxidation is split up into two classes, one being nitrogenous, the other, which is the fat-producing element, being non-nitrogenous. Carbohydrates furnish but an inconsiderable proportion of the fat. Fats are taken into the blood in the form of an emulsion, which is absorbed by the lacteals and passes into the venous circulation, or after combination, resulting in the formation of glycerophosphoric acid, fatty acid and soaps. This combination in the small intestine produces a soap which is capable of retaining in solution a certain proportion of the fat. The action of the pancreatic secretion, and of the bile, upon the fat, results in the development of fatty acids and glycerin, the latter combining with phosphoric acid having its origin in the phosphates, from which it is separated by the action of hydrochloric acid derived from the gastric juice. This diffusible glycerophosphoric acid and the soap, elaborated in this manner, are absorbed, entering the general circulation and the tissues where they are oxidized. If the amount of fat taken is in excess of what these substances (soaps and alkaline matters) are able to retain in solution, it appears in the blood in the form of minute oil globules (lipæmia), a condition which is not rare after a heavy meal containing an excess of fatty matter. If this condition is continued, the excess is deposited in the adipose tissue and in the liver, being removed by reducing the amount of fat in the food, by active exercise and during fever. A certain amount of stored fat is essential to endurance, and a degree of exercise or a diet which effects its reduction to the minimum is unwise.

Elimination of fat taken in quantities so great that oxidation and storage are incapable of disposing of it, is by the mucous and cutaneous surfaces. The stools contain fat if the secretions of the pancreas and liver are defective; the skin is oily, unhealthy, and often presents

eruptions, especially acne; even the urine may contain fat, representing a form of chyluria. It was stated that (contrary to a very common impression) the carbohydrates furnish but a small portion of the fat. It may be further added that they are seized upon more quickly and oxidized more rapidly than the fats, consequently, if taken in too large amounts the latter, in some degree, fail of oxidation and are stored in the tissues. As an accumulation of fat in the various regions to be named is a normal condition it is impossible to draw a sharp line of demarcation between that which is physiological and that which is pathological. The fatty tissue is well developed in utero, most babies being quite plump at birth. The fat is quite uniformly distributed and continues so during childhood and early adult life; later it tends to accumulate in certain situations, and may diminish upon the surface while increasing in deep regions. In the superficial parts the increase is most marked in the abdominal walls, neck, breasts, and gluteal regions; and in certain places where the skin is loose, as the eyelids, penis and scrotum, there is no disposition to its accumulation. The muscles may be infiltrated with fat, and have a pale brownish or yellowish color. In the deeper parts the distribution is also unequal. It may involve the connective tissue of the mediastinum, accumulate beneath the epicardial tissue, and develop between the muscular fibres of the heart with resulting compression, wasting, and fatty degeneration.

It is not rare for the obstruction to excite hypertrophy of the left ventricle. Fat is not found beneath the visceral layer of the pleura nor the parietal layer of the pericardium. The omentum is a favorite site for its accumulation. The normal weight is six or eight ounces, which may be increased to six to ten pounds, and even thirty pounds has been reported. Fat does not appear in the walls of the intestines or stomach, but a thick layer may develop within the mesentery. The liver is infiltrated with fat with resulting enlargement. The pancreas is also enlarged.

The gall-bladder contains a little weak bile. There may be some degree of cirrhosis. The kidneys are diminished, also the spleen, which may be encapsuled with a thick layer of fat. Fat is not found within the skull, but may exist in the spinal canal in quantity. The weight to which fat people may attain is great, and in rare instances enormous. Children of two years have weighed 65 pounds, of four years 137, and at eleven or twelve years 200 to 400 or more pounds. The greatest weight of an adult, which seems to be well authenticated, is 730 pounds. Weights of more than 800 pounds have, however, been reported.

Symptoms.—While the development of obesity is usually slow it is in exceptional cases relatively rapid. I have under my care a girl of ten years who has gained about sixty pounds within one year, most of the increase occurring within the first six months. The increase is first

noticeable in those visible parts which normally contain considerable fat, therefore, the cheeks, chin, neck and backs of the hands. The bust increases in size, the shoulders become broad and rounded, the abdomen prominent and the calves rotund. The appearance is much changed with high degrees of obesity. The eyes appear diminished, the cheeks are large and flabby, the neck is short and forms a "double chin," and there is a lack of expression.

The gait is waddling, and in order to preserve the equilibrium the head and upper portions of the body are bent backward. Necessary movements are rendered difficult, and many are impossible without assistance. There may be backache from supporting the heavy abdomen. There may be hernia, varicocele, distention of the hæmorrhoidal veins, or varices or œdema in the lower extremities. The skin is sensitive and tends to the development of eczema, acne and intertrigo at points where the folds of skin are in contact. The accumulation of sebum and sweat at these points undergoes decomposition and causes an offensive odor and irritation. Sweating is easily excited.

Obese persons often manifest marked evidences of plethora or anæmia, the symptoms of each not presenting any peculiarities on account of the association. The hæmoglobin is sometimes reduced, but not the number of red blood-corpuscles. Unless the left ventricle is hypertrophied the heart-sounds are feeble and removed. If hypertrophied, the area of dulness is increased and carried to the left. The pulse is often accelerated, but nearly as frequently it is slow. Dyspnœa and palpitation are common. Many of the symptoms referable to the chest are the result of encroachment of fatty deposits upon the chest cavity. Marked changes may take place in the pulse due to the condition of the heart and that of the blood. Percussion and auscultation are affected by the thickness of the parietes. Dulness over the sternal region is indicative of a collection of fatty tissue within the mediastinum. Physical exploration of the liver is of little value on account of the amount of fat in the abdominal walls. The mental state is gradually enfeebled and there is a marked tendency to somnolence, especially after food. The temperament is usually phlegmatic, with indisposition to exercise. The urine is often diminished in quantity. It is of acid reaction, and contains an excess of certain solids, especially urates and uric acid or oxalate of lime. Sugar may be temporarily present. Many obese persons become diabetic. Women may have a premature cessation of the menses or a variety of menstrual disorders. Obese women are frequently sterile, and ovarian diseases and uterine displacements are quite common, resulting from pressure of the fatty accumulation and disorders of the circulation.

The sexual appetite is usually diminished and may be lost. Spermatozoa may be absent from the semen. In men these sexual disorders

may be due to a collection of fat upon the spermatic vessels with consequent impairment of nutrition of the testicles. The digestive organs frequently continue in good condition. Occasional attacks of acid dyspepsia are common. Pressure by the fatty tissue, circulatory disorders, and excessive eating, favor catarrh of the stomach and bowels. Obese persons are prone to many affections, and acute diseases pursue an unfavorable course which is largely due to feeble circulation, imperfect radiation from the surface, and impaired function of many of the vital organs from infiltration or degeneration. The more common of the affections to which obesity predisposes are arthritic troubles, especially gout, diabetes mellitus, and biliary or renal calculi.

Prognosis.—After obesity is a well-established condition it is rarely that it is removed permanently, especially if it is hereditary. The obesity of infants, and that sequential to certain diseases, subsides spontaneously. Obesity is in general not considered seriously enough, for it leads to great discomfort, impairs efficiency in all of life's duties, favors dangerous affections of many organs, increases the mortality from acute disease, and, independently of acute disease, materially shortens life. Death may result from many causes, viz., gradually failing circulation, or sudden heart failure, cerebral hæmorrhage from associated atheromatous changes in the cerebral vessels, acute pulmonary affections, angina pectoris, rupture of the heart, or uræmia.

Treatment.—Treatment must be pursued with two objects in view, first, to limit the supply of those food substances which supply the fat, and secondly, to improve oxidation. It must not be forgotten that much harm may be worked by the careless or unintelligent application of a "system" of treatment. In every instance the individual to be treated must be carefully examined in relation to the condition of all the vital organs, which must be carefully watched during the progress of treatment and regulated thereby.

The normal diet consists of nitrogenous food, carbohydrates, fats, and water. Aside from the fat taken, this substance is formed from both carbohydrates and food rich in nitrogen. Dieting for obesity consists in the partial withholding of those elements which most favor accumulation of fat in the tissues. Experience has seemed to indicate that fat and the carbohydrates may be withdrawn with the best results, although it will be seen from a scrutiny of the diet tables appended, particularly that of Ebstein, that opinions are not a unit upon this question. Concerning the various methods of dieting, each possesses elements of merit, which must be selected as best suited to individual cases. The method which has had the greatest popularity for many years is the so-called "Banting system," which excludes fats and carbohydrates, reduces the total amount of food, and restricts the use of liquids. This plan forces the organism to feed upon its own fat. The method is successful

if perseveringly carried out. It not infrequently causes gastric disturbance, lithiasis, with resulting calculous troubles, vertigo, syncope, and a variety of nervous symptoms; even insanity has been reported. These results must be attributed, however, to an injudicious carrying out of the method. Under no circumstances should the withdrawal of the objectionable articles be accomplished rapidly, and the patient should be protected from injudicious exercise during the most important period of the treatment. Nor should rapid loss of flesh be permitted, many of the ill effects of treatment being due to this cause. I have prescribed Vogel's modification with satisfaction. The several meals are as follows: *Early breakfast:* Coffee, minus sugar or milk; toasted bread or zwieback, without butter. *Late breakfast:* Two boiled eggs, lean meat or ham taken raw, with a cup of tea. *Dinner:* Plate of weak soup, cooked lean meat, potatoes moderately, a small amount of bread, and green vegetables freely. *Supper:* Bouillon or tea, cold lean meat in some form, little bread, soft boiled eggs, salad.

Ebstein's method permits the free use of fats at the expense of other articles of food. The carbohydrates are rapidly excluded. The three daily meals suggested are as follows: *Breakfast:* one cup of black tea (without sugar or milk), with three ounces of well-buttered toast. *Dinner:* soup, with marrow of bone often added; cooked meat, to which a fat gravy is added; vegetables, moderately (avoiding potatoes and turnips); salad, stewed fruits without sugar; fresh fruit, light white wine, if desired. Soon after dinner a large cup of clear black tea. *Supper:* one egg, fat roast meat, sausage, ham, fresh or smoked fish, wheat bread well buttered, a cup of clear black tea, and sometimes fresh fruit or cheese.

Oertel advises much the same diet, but with less fat and more of carbohydrates. He also limits the amount of water taken, and abstracts it by means of Turkish baths, hypodermatic injections of pilocarpine, and mountain-climbing.

According to Bouchard, the condition of the urine is of importance in the selection of food, albuminous food being reduced when nitrogenous products are present in large quantity, and when urea is diminished the amount of food is to be reduced, followed by increase after improvement. He considers that the carbohydrates should represent four-fifths of the total food taken; and that oxidation, consequently destruction of fat, may be increased by a freer use of vegetable acids, which may be taken as organic salts of potassium in fruits and fresh vegetables. Free acids should be avoided, as they disintegrate the tissue-cells.

Aside from these well-known plans of treating obesity, we may mention the milk diet, taking three to four quarts daily; the meat and hot water diet of Salisbury; the grape cure; dieting in association with massage, sweating, oxygen inhalations, living in high altitudes, etc., all of which are valuable and may be considered for special cases.

With due observation of the heart, all obese persons should be advised to exercise freely in the open air. The particular forms of exercise must be selected with care and the effect noted. The clothing should be as light as compatible with proper protection, and cold sponge bathing, if well borne, should be regularly employed each day.

Certain spas, notably Carlsbad, Vichy, Kissingen and Ems, are beneficial, perhaps as much for the reason that patients are stimulated to carry out the details of their treatment more faithfully, as from any particular influence of the waters. Some observers prefer the *crenæ* (cold springs) rich in Glauber's salts, to the *thermæ* (hot springs) which are more apt to cause syncope or cerebral hæmorrhage if injudiciously employed, and would therefore prefer such a resort as Marienbad to Carlsbad.

Obese persons who are anæmic should avoid much laxative water, and will secure more favorable results from chalybeate-alkaline waters such as are found at Kissingen.

The use of drugs for the reduction of corpulence cannot be commended. Phytolocca, which has been extensively employed, is useless, the good results reported being due to the dietetic and other measures which are adopted at the same time.

PARASITIC AFFECTIONS.

CESTODES (Tape-Worms).

This species of parasite, although long observed, has only recently been fully understood in its life-history. We know that while the fully developed tape-worm infests the intestinal canal of man and of other vertebrates, in the larval state they are found in the muscles and various internal organs, being of such small size as to readily escape observation and presenting no apparent relationship to the intestinal (mature) form.

As the name indicates, the tape-worm is a very long tape-like worm, white, and composed of sections or joints (proglottides). While the tape-worm is composed of a large number of joints, each joint is independent and may be detached and live a separate life. The head is small and possesses suckers and hooklets arranged in circles, with which the parasite attaches itself to the mucous membrane. The sections are produced by growth and division of those composing the neck, which are immature, *i. e.*, in a developmental stage. With the gradual passage of the segments down the line growth continues with the production of a sexual apparatus which possesses the ability of auto-impregnation. With still greater removal of the section from the head the contained uterus becomes distended with eggs, and the remaining elements of the generative apparatus atrophy. The mature segments are detached singly or in sections of two, four or more, and are discharged with the stools or escape from the anus independently of bowel movements. The segments may or may not have discharged their eggs before their escape. The vitality of both the segments and the eggs is continued for several days after their discharge. Being ingested by some animal feeding where they have been carelessly deposited, the eggs and proglottides undergo digestion with liberation of the embryos (proscolices).

The embryos possess six chitinous spicules arranged in pairs, with which they attack the mucous membrane, securing entrance to the deeper tissues, and by their direct penetration or through the circulatory current, find their way to the muscles, the liver, or other organs. Having secured a location, they remain in a rather quiescent state for a time. A certain amount of change takes place, consisting essentially in a loss of the spicules and the development and establishment of the larval form (scolex), which becomes enveloped in a connec-

tive tissue capsule, created by the inflammatory action which is excited by the new tenant. The scolex has a head not unlike that possessed by the fully developed tape-worm. The neck is short, terminating in a sac into which the head and neck are inverted. The sacs are, in common parlance, called measles, and meat containing them is known as measled meat. They are elliptical in form and may present a depression marking the position of the head. The scolex undergoes degenerative changes only while remaining in the tissues, ultimately appearing much atrophied and occasionally calcified; but if such infected meat is eaten, the scolex is set free by destruction of the enveloping sac, and attaching itself to the mucous membrane, develops into the fully formed tape-worm. The duration of the life of the tape-worm in its intestinal home is not known, but it undoubtedly lives for many years. As great an age as thirty-five years has been attributed to one specimen. A single worm is developed, as a rule, but it is not uncommon for two or three to be expelled at one time, and scores have been counted in the discharges of a single individual. Of the several varieties of tape-worm which will be described, two have been found to inhabit the same host at the same time, and it is not uncommon for several species of parasites to exist in one individual. The tape-worm in its larval state but rarely inhabits man. The cysticerci of the pork tape-worm (TÆNIA SOLIUM) are occasionally met in man, while the *tænia echinococcus* appears in the human species in this form only.

TÆNIA SAGINATA.

The form of tape-worm most frequently met is the beef tape-worm, the TÆNIA SAGINATA, sometimes called the *tænia mediocanellata* or *unarmed* tape-worm.

In its mature state this parasite is known to inhabit only the small intestine of man, being derived from beef used as food, in which flesh it exists in its larval state, and has not been destroyed by proper cooking. It varies in length from five to thirty or more feet, is flat, tape-like, soft, and whitish or yellowish in color. It is composed of segments, which may number as many as a thousand, or 1,369, as counted in a case of which I have knowledge. The head is squarish, flattened upon the top, about the size of a yellow mustard-seed, and has four suckers of a hemispherical outline, with which it attaches itself to the intestinal surface. The neck is



FIG. 59.—TÆNIA SAGINATA; PROGLOTTIS; EGG. (von Jaksch.)

slender, somewhat flattened, not as broad as the head, and merges into the body, the segments of which are at first greater in their breadth than their length, but with maturity becoming longer than they are broad. The genital aperture is represented by a papilla upon the sides of the more mature segments, near their centres, and irregularly alternate upon the two sides. The uterus, distended with eggs, may be indistinctly seen as transverse tubes united centrally by a longitudinal tube. It is rendered more distinct by drying and compressing the segment.

The eggs are oval, of a brownish color, and about 0.035 mm. in length. Their number is enormous, those found in a single segment having been estimated at thirty-five thousand. The eggs are discharged into the intestine by the mature segment either before or after it is detached, or after its escape from the intestine. After the loss of the eggs the segment appears shrunken and may migrate through the anus or be expelled with the fæces.

The ox is infected by eating segments or eggs which have been passed at stool in pastures where cattle graze. The embryos find their way to the muscles, even that of the heart, and to the lungs, liver and other organs. The measles vary in size from a minute point to that of a pea and are of a whitish color. The dependence of the tænia saginata upon the measles of beef has been positively established by feeding the latter to man as well as the lower animals. The predominance of this form of tape-worm over other varieties, which is observed in this country, is due to the common practice of eating insufficiently cooked beef.

TÆNIA SOLIUM.

The *pork tape-worm, armed tape-worm,* or TÆNIA SOLIUM, is much less frequently met than the previous variety. Before its separation from the tænia saginata it was considered to be the common form. It is more common in Eastern countries. It is a soft, whitish, tape-like worm, seldom less than five or six or more than ten feet in length, and may consist of as many as eight or nine hundred segments, which, if mature, measure one-half inch in length and a little less in breadth. The head is smaller than that of the tænia saginata, being compared to the size of a pin's head. It is round, supplied with two rows of hooklets, four sucking disks, and is considerably pigmented. The hooklets, which number about thirty, are attached to a central papilla, the suckers

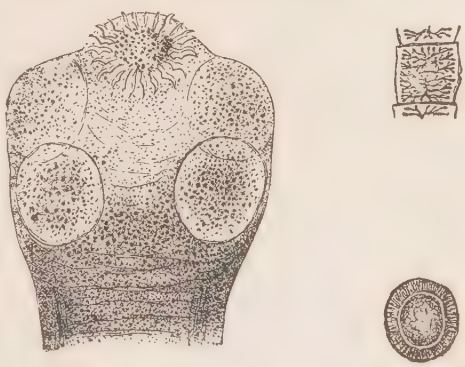


FIG. 60.—TÆNIA SOLIUM, HEAD (MAGNIFIED), PROGLOTTIS (ACTUAL SIZE), AND EGG (MAGNIFIED). (von Jaksch.)

being placed more upon the sides of the head. The neck is thin and about one inch in length. The transition into the fully developed segments is gradual. The breadth of the proglottides is greater than their length until fully developed, when the length is slightly greater than the breadth. The arrangement of the uterine cavity is much the same as in the tænia saginata, but the transverse branches are much less numerous. The eggs are somewhat smaller than those of the beef-worm, more nearly spherical, and measure rather more than 0.030 mm. in length.

The measles, or larval condition of the tænia solium, was designated the cysticercus cellulosæ at a time when its relationship to tape-worm was not known, it being regarded as an independent parasite. They are firm whitish bodies of oval shape, the largest not exceeding a pea in size. They occupy the connective tissue, especially that associated with the muscles, although they are found in subcutaneous tissues and in many of the organs. The external sac, which is of connective tissue, encloses the scolex.

The tænia solium is most frequently found in the hog, but has been observed in various animals, particularly the dog, deer, bear, and rarely in the sheep. Were it not for the custom of thoroughly cooking pork man would be much more frequently infected. The course of development, after the liberation of the scolex in the stomach, is the same as in the case of the tænia saginata. The hold which the scolex takes upon the wall of the intestine is much greater, however, as it is not uncommon for the neck to fracture when the worm is expelled by treatment, leaving the head attached to the mucous membrane. Single segments are detached, or sections consisting of several segments are expelled, by their own power of motion.

The mature worm requires about three months for complete development, and its duration of life is supposed to be ten or twelve years.

A number of very rare forms of tape-worm can be little more than mentioned. The Tænia Elliptica is but rarely found in man, more frequently in domesticated animals, especially the dog and cat. It varies from a few inches to about one foot in length. The segments are elliptical, which has given rise to its name. The rostellum is armed with about sixty hooklets.

BOTHRIOCEPHALUS LATUS.

The Bothriocephalus latus, or "*broad tape-worm,*" belongs to a genus now clearly distinguished from the tænia. It is the largest species of parasite infesting man. Its length varies from twelve or fifteen to twenty-seven feet. Its breadth is about three-quarters of an inch. It is common in portions of Europe especially Sweden, Russia, Poland, the West of Switzerland, and portions of Prussia. Its prevalence in Switzerland is very great, it being claimed that 25 per cent. of the

population of Geneva are infected. Imported cases only have been observed in this country. This worm, of greatest length, contains more than four thousand joints, it is of a grayish color, soft, and in general relationship of parts to each other is similar to the other large tape-worms which have been described. The head is elongated, and without hooklets, but upon either side is a long elliptical sucker. The neck is short. The segments of the body increase in width until they are two, three or four times as great as the length. Some of the terminal segments are relatively narrower and longer. The uterus consists of pouches, located centrally in the proglottides and arranged somewhat like a rosette. It is filled with oval eggs of a brownish color, measuring about 0.07 mm. in length and with a lid at one extremity, through which the ovum escapes. The genital opening occupies the centre of the flat, ventral surface. Like the other forms of tape-worm this one inhabits the small intestine. It is usually single, but several may be met, and not rarely, in association with one or more different varieties of worms. Single joints, or sections composed of several segments may be passed. The latter is much the more frequent.

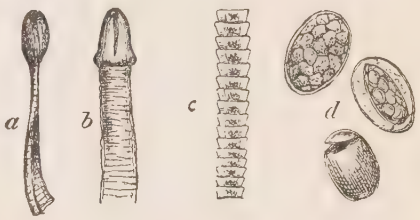


FIG. 61.—HEAD OF BOTHRIOCEPHALUS LATUS. (*a*) SEEN ON EDGE; (*b*) SEEN ON THE FLAT; (*c*) PROGLOTTIDES; (*d*) EGGS.

The embryo is furnished with six spicules arranged in pairs. These are finally detached. It is surrounded by a ciliated envelope with which it is enabled to swim upon water. This is likewise lost within a few days, the embryo then progressing by amœboid motion. It is probable that the intermediate host may be one of several varieties of fish, the scolices being found in the muscles and internal organs of the trout, pike and eel-pout.

Rare varieties are the *Bothriocephalus cordatus* and the *Bothriocephalus cristatus.* The former, which Böttger considers identical with the Bothriocephalus latus, is three to four feet in length. It has been observed in man and is the common tape-worm of the dog in Greenland. The head is large, short, and has a sucker and deep longitudinal groove upon each side of the head, which is flattened.

RARE VARIETIES OF TÆNIA.

Tænia Cucumerina.—This variety is believed by many to be identical with the tænia elliptica. The former has been found most frequently in the dog, and the latter in the cat. The head of this variety is provided with four suckers and about sixty hooklets. They live in the small intestine and are found in considerable numbers. The eggs adhere to the hair

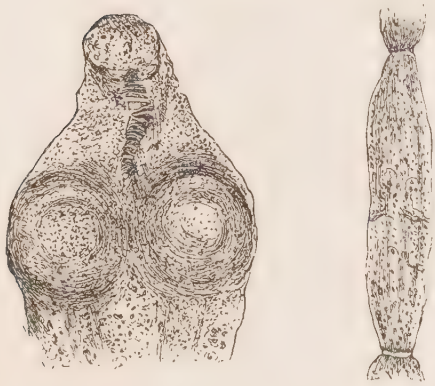


FIG. 62.—TÆNIA CUCUMERINA; HEAD; PROGLOTTIS (MAGNIFIED). (von Jaksch.)



FIG. 63.—TÆNIA NANA; HEAD WITH ROSTELLUM DRAWN IN; PROGLOTTIS; EGG. (von Jaksch.)

about the anus, are taken by lice and, undergoing larval development, are swallowed with their host, with resulting reinfection. Undue familiarity with cats and dogs results in infection of the human species.

Tænia Nana, the dwarf tape-worm, has been met a number of times. It is only about one-half inch in length and composed of about 150 to 175 segments. Its rostellum is surrounded with a single row of hooklets numbering about twenty-four. It has been found in large numbers in the duodenum.

Tænia Lavo-punctana has been observed but twice. It is less than one foot in length. The segments are about two millimetres in breadth and about half that in length. The mature joints are of a pale, brown color, and distended with eggs. The uterus is exceedingly simple.

The **Tænia Madagascariensis** is known only from some fragments and these have been but twice observed.

GENERAL STUDY OF THE TAPE-WORMS.

Etiology.—The tape-worm is widely distributed, the people of no region of the world possessing immunity. It has been shown that the human species becomes the habitation of the tape-worm mainly as the result of the ingestion of raw or imperfectly cooked meat, especially beef and pork, and that rare forms may be developed from scolices taken in fish, and, further, that certain forms are very rarely transmitted from domestic and other animals to man. Proper cooking of animal food is, therefore, the most important item in prophylaxis. The regions of country where these parasites are most frequently met are those in which the habit of eating raw or insufficiently cooked food is a common prac-

tice, also too intimate association with the lower animals. Tape-worm is also common in certain regions which receive a supply of meat from highly infected districts. Various occupations favoring the eating of uncooked food may be said to predispose to tape-worm.

Morbid Anatomy.—Remarkably few anatomical changes are found in the intestines or related parts which can be attributed to the influence of the tenant. The ulceration and perforation of the intestines which have been reported as due to the influence of the tape-worm are, in many instances at least, the result of other causes. Through such openings the worm or portions of it may pass, entering the peritoneal cavity, urinary passages, the pleural sacs, or even penetrating the abdominal wall. The worm has been frequently expelled during serious illness, such as the continued fevers, inflammatory affections of the bowels, or disease of the parasite itself.

It has been shown that the tape-worm occupies the upper portion of the small intestines. It may be coiled in this region, leading to symptoms of obstruction, or extended more likely; the position is not the same at all times. Sections of the worm may separate and are found in the lower portion of the intestinal tract or even in the stomach. Its presence in the latter organ is suggestive of deterioration of the parasite and is likely to be followed by its death and evacuation. Auto-infection with the cysticercus is liable to occur if portions of the tænia solium enter the stomach. Sections of the broad worm are frequently passed at stool. Single segments less frequently.

Symptoms.—These are often notable for their absence, the presence of the parasite being discovered accidentally by observing segments in the stools, their discharge into the clothing or in vomited matter. The symptoms are either reflex in character, or are due to the direct influence of the parasite upon the intestinal walls. As far as we know, tape-worms do not produce substances which exert an irritant effect of a local or general character.

Of local symptoms colicky pains, which are located about the centre of the abdomen in most instances, are most prominent. The appetite may be poor or excessive. The patient may feel relieved of pain and general discomfort after eating. Nausea and vomiting spells may occur occasionally, perhaps in the morning, suggesting pregnancy. Associated with these evidences of disordered digestion or of catarrh of the stomach and bowels are general symptoms in the nature of lassitude, depression, etc. Children are highly sensitive; adults may develop prominent symptoms of disturbance of the nervous system, viz., pruritus of a general character or limited to the nose or anus, vertigo, palpitation, choreiform movements, headache, dilatation or irregularity of the pupils, delirium, convulsions of an epileptiform character, at times closely simulating epilepsy but disappearing upon the discharge of the

worm, mental depression, hypochondriasis, spasmodic cough, asthma, etc., have all been supposed to arise from the irritant influence of this disagreeable tenant. Symptoms of a high degree of anæmia have been repeatedly observed especially in connection with the bothriocephalus latus, less frequently with the tænia saginata and the tænia solium. Associated with the anæmia there may be gastro-intestinal disturbance, œdema, palpitation, and extreme feebleness. The liability of the possessor of the tænia solium becoming infected with cysticerci from the presence of the sections in the stomach or the premature discharge of the eggs in the upper portion of the intestines, or their deglutition, is considerable. The symptoms to which they give rise depend upon their location. If in the muscles and superficial connective tissue, there is considerable stiffness, tenderness and pain; if in the superficial parts, the nodules may be palpated. Their location in the brain produces serious symptoms, viz., localized spasms or paralyses, general convulsions or mental aberration. In the eye they may excite a variety of changes which may terminate in complete loss of vision.

Diagnosis.—The only positive evidence of the presence of the tape-worm is the discharge of the segments from the body. Search for eggs, in the intestinal discharges is often futile as they are usually expelled after the escape of the segment. The joints cannot be confounded with any other substance in the eyes of one acquainted with the tape-worm. Most frequently a strip of exudate formed in the course of pseudo-membranous enteritis is supposed by one without experience to be a link of the tape-worm.

Prophylaxis.—The prevention of infection is accomplished by eating only meat which has been properly cooked. The subjection of meat to a boiling temperature insures the destruction of the measles. Infection of animals is prevented by the avoiding of defecation by persons infected with tape-worm in places where the animals feed. Cleanliness of person and of habitation is important. Too little care is exercised in the handling and disposal of the parasite after its expulsion. Physicians should be especially cautious in this particular, as many specialists have been infected in this manner. The parasite should always be handled with forceps, and the hands, including the finger-nails, thoroughly cleansed at once. The risk from vomit is considerable, especially in the case of the pork-worm, as the larval condition may be established as the result of regurgitation of portions of the worm into the stomach. In certain countries where all meat is now officially inspected prior to sale the number of infections has notably decreased.

Treatment.—The proper treatment of the tape-worm is its expulsion. The various tæniafuges in use simply diminish the activity of the worm and it is then expelled by a purge. Their action is favored by a period of abstemiousness in diet, which should continue for about three

days before the administration of the medicine. During the last twenty-four hours of this preparatory period nothing should be taken but a little gruel, broth, or milk. A purge is of advantage during this preliminary stage of the treatment. A lack of success in expulsion is frequently due to neglect of proper preparation of the patient.

It is seldom that the etherial extract of the *male fern* is unsuccessful. Thirty minims should be given at bedtime and sixty minims in the morning. The patient should remain in bed and receive an active purge, preferably castor oil, about eight hours after the morning dose. Some observers order as much as two drachms of the male fern at one dose, but this must be seldom necessary. It is best given in gelatin capsules, which should be filled at the time of taking. Traction should not be made upon a projecting portion of the worm for fear of fracture and resulting retention of the head, which would lead to reproduction of the worm.

The alkaloids of the pomegranate-rind, viz., *pelletierine* and *isopelletierine* are much used, but are too expensive for general use. Thirty centigrammes of the sulphate of one of these substances may be given in solution, combined with fifty centigrammes of tannic acid, followed in a quarter of an hour by eight ounces of water, and an active cathartic one half-hour later (Dujardin-Beaumetz). I have used successfully the *tannate of pelletierine* in doses of fifteen to thirty grains, in connection with the general plan advised for the use of the male fern.

Recent experience with *naphthalin*, as a tæniafuge has been favorable. I have used it successfully, administering ten-grain doses before meals for several days before and after the expulsion, the latter being accomplished by the administration of thirty grains in the morning, followed by a cathartic three hours later. The powdered crystals are not unpleasant and may be washed down with a little water.

The *pumpkin seed* is often used successfully, and is a pleasant remedy, especially for children. From one to two ounces of the powdered seeds, mixed with some pleasant substance, should be given in the morning, followed by the usual purge in the afternoon.

Turpentine, *kousso*, or *koussin*, *thymol*, *santonin*, *carbolic acid*, and many other drugs have been used successfully, and may be considered in obstinate cases. I have not employed them as all of the cases which I have seen have yielded to the remedies previously mentioned. Preparatory treatment should not be neglected prior to the use of any of these agents.

TÆNIA ECHINOCOCCUS.

The tænia echinococcus is a cestode, the smallest of the tænia, possessed of four segments in its fully developed state, and is generally about one-fourth of an inch in length. It infests with especial frequency

dogs, wolves, jackals, but herbivora, particularly sheep, are by no means exempt. In man it occurs only in its larval state, forming thus the well-known echinococcus cysts. Attempts have been made to describe a number of varieties of this parasite, thus far without success, because the tænia echinococcus, no matter what its host may be, is essentially the same living organism. The distribution of the tænia echinococcus is widespread, although it is far more frequently observed in some countries than in others. In Iceland, for example, where the association of the inhabitants with their dogs is so close, it has been estimated that one-sixth of all deaths arise from this cause. The parasite seems to be only less frequent in Australia. In America and England echinococcus is a very rare disease; indeed, well-authenticated reports of it as infesting dogs are wanting in both countries. In the Argentine Republic it is on the increase, notably among those members of the community notorious for their uncleanly habits.



FIG. 64.—TÆNIA ECHINOCOCCUS. (Cobbold.)

Description of the Tænia Echinococcus.—As already stated, the tænia echinococcus is a small cestode of about one-quarter of an inch in length, possessed of four segments in its fully developed condition. The first segment—the head—is surmounted by a pointed rostellum, below which is a double row of comparatively large-rooted hooks, from thirty to forty in number.

The double row can only be discerned with the greatest care. Below these again are four suckers, and these are succeeded by an elongation of the segment called the neck. The final segment is as long as all the others combined and contains the eggs, which may be as many as five hundred in number. To the naked eye the appearance of the parasite is such that it may be readily confounded with the intestinal villi.

The usual method by which the eggs enter the human body is through the drinking water. Not infrequently, however, they are placed on the lips by dogs when playfully fondling their masters. The eggs being taken into the stomach, the shell is digested and the embryos are set free. They rapidly bore their way into the bloodvessels, especially those of the portal system, and thus are carried to the liver,—the most frequent situation of echinococcus cysts. When they enter the systemic vessels, they are carried most frequently to the lungs, but the brain, kidneys, heart, orbit, and other parts, may be their final resting-place.

The relation between the tænia echinococcus and hydatid cysts has been proven by the fact that the feeding of animals on the contents of hydatid cysts taken from man produces the parasite in the subject of the experiment.

Development of the Echinococcus.—The development of the echinococcus cyst cannot be described briefly in any better language than that of J. Bland Sutton. "At first they are small white dots with thick homogeneous transparent capsules, with concentric lamination inclosing coarse granular contents (Fig. 65). After the cyst has been growing five months and has attained a diameter of half an inch, echinococcus heads begin to bud from its walls. Each of these heads when wholly formed is about 0.3 mm. in length when fully distended, and represents the head and neck of an adult echinococcus. Each head is furnished with four suckers and an armed rostellum, the hooklets of which are very small. Numerous calcareous particles are lodged in its parenchyma. The rostellum with its hooks and suckers can be retracted and extended. In examining such specimens under the microscope, it is usual to find them in the inverted or retracted condition. The heads or scolices are formed within brood-capsules, and Leuckart emphatically states that they are throughout life directly continuous with each other by means of the parenchyma of the main cyst, and cannot remain about the cavity and retain their vitality. The walls of hydatids consist of two layers, an outer or cuticular and an inner layer or parenchyma. The cuticular layer is highly elastic and curls up when divided; the parenchyma consists of granular matter, cells, and muscle fibre. The brood-capsules are developed from the parenchyma; each brood-capsule, like the parent cyst, has two layers, an outer parenchymatous and an inner cuticular, thus reversing the conditions of the mother cyst. Leuckart maintains that the scolices bud from the outer wall of the capsule, but when fully developed invaginate, so that which was formerly the internal cuticular surface of the head now becomes the external. The mother cyst grows larger as fresh brood-capsules are formed. Every echinococcus does not develop brood-capsules, and may attain a large size and yet remain sterile. The presence of the cyst irritates the surrounding structures, and leads to the formation of a spurious capsule of fibrous

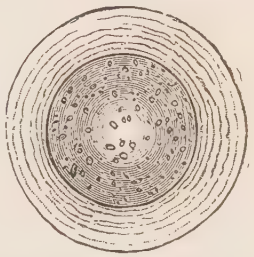


FIG. 65.—HYDATID OF FOUR WEEKS' GROWTH, SHOWING ECTOCYST AND ENDOCYST. (After Leuckart.)



FIG. 66.— GROUP OF ECHINOCOCCUS HEADS. (Busk.)



FIG. 67.—ECHINOCOCCUS HOOKLETS FROM URINE. (von Jaksch.)

tissue, sometimes of great thickness and usually very vascular. The brood-capsules with their contained scolices occur in clusters; each capsule is of the size of a No. 5 shot. Occasionally the capsules become much larger and form internal daughter cysts, attaining in some specimens the size of a Tangerine orange. Such daughter cysts may develop cysts of their own or granddaughter cysts. When the mother cyst is, as a rule, of very large size, it contains as many as two or three thousand daughter cysts, varying in size from a pea to an orange."



FIG. 68.—ECHINOCOCCUS-HEAD. (After Huxley.)

Location of Echinococcus Cysts in Man.—Echinococcus cysts may be found in any portion of the body. The liver, however, is their favorite location, next to which come the lungs. Even the bones may be involved occasionally, the most prominent feature of such cases being increased fragility of the affected tissue.

ECHINOCOCCUS OR HYDATID DISEASE OF THE LIVER.

Pathology and Morbid Anatomy.—One remarkable fact concerning hydatid disease, as it affects the liver of man, is the rarity with which the tumors are multiple. The size of the cyst ranges all the way from that of a pea to one as large as the surrounding tissues will permit. Any portion of the organ may be invaded, but the disease is more frequently found in the right lobe. When the tumor attains a large size, it may by pressure on neighboring organs, exert marked changes in their functions. In some cases it produces important alterations in the liver structure. It not infrequently happens that it excites inflammation and so produces adhesions to adjacent structures. Perforation into neighboring cavities as the pleura and peritoneum may take place.

Symptomatology.—The symptoms of hydatid disease of the liver depend in great measure on the size and situation of the growth. When small they may exist without the slightest disturbance of hepatic or other functions. When large, many of the symptoms arise from the mechanical effects of the tumor.

Thus it may from upward pressure on the diaphragm displace the heart and lungs and so excite dyspnœa; from pressure on the portal vein, develop ascites; sometimes it presses upon the hepatic vein or vena cava, when œdema of the lower extremities ensues; in still other cases, the bile-ducts are obstructed and jaundice is a result. In addition to these disturbances of function, the weight of the cyst produces sensations of weight and dragging in the right hypochondrium. These symptoms differ in no particular from those arising from any other growth of the same size and similarly situated. The physical signs, however, furnish important diagnostic data. Inspection reveals a fulness in the

region of the liver. Palpation reveals nodules, which give a firm resisting elastic feel, and an indistinct sense of fluctuation. Briancon and Pierry have called attention to a phenomenon which they believed to be diagnostic. It consists of a peculiar vibratory feeling under palpation, which has been described as the hydatid fremitus. Too much reliance must not be placed upon it, however, for it is present in any case in which a parent sac contains fluid in which daughter sacs float, and is not always present in hydatids. Frerichs, for example, found this symptom absent in about half his cases. It has been described as giving a sensation similar to that produced by the purring of a cat.

Constitutional symptoms are, as a rule, absent. Pain is rarely present. Sometimes, however, there is a gnawing feeling at the epigastrium.

The cyst may undergo suppuration, in which case the symptomatic picture changes. Rigors, pyrexia and sweat appear in addition to the above phenomena. The cyst may rupture into important organs or cavities, the symptoms varying according to the seat of perforation. When the rupture takes place into the peritoneum urticaria is a prominent symptom, due probably to the absorption of toxic products. The same condition has been observed to follow aspiration of hydatid cysts.

Diagnosis.—The diagnosis of hydatid cysts of the liver is always a difficult matter. One should not attach too much importance to a history showing that the patient has been too much in the companionship of dogs, as infection may take place through drinking impure water, or the accidental caresses of a dog which may have long since been forgotten. Probably the information on which a diagnosis can be based is that derived from an examination of the contents of the cyst after aspiration. This fluid ranges in specific gravity from 1005 to 1015, and contains little or no albumin, and is rich in common salt. Attention has also been directed to the presence in it of succinic acid and inosite, or muscle sugar. The albumin may be discovered by the ordinary tests for that substance in the urine; common salt, by the addition of a standard solution of nitrate of silver. The discovery of succinic acid is a more complicated process. The fluid is evaporated, acidulated with hydrochloric acid and agitated with ether. The ether is now evaporated, leaving a crystalline mass, which is dissolved in water. The addition of a solution of chloride of iron produces a gelatinous rusty precipitate, consisting of succinate of iron. The examination for inosite is too complicated a process for clinical use.

Microscopic examination of the fluid gives still more definite information in the majority of instances, for in this way the presence of shreds of membrane, scolices, and hooklets are discoverable. Especially should they be detected, when care is taken to sediment the fluid. They are well illustrated in Fig. 67, better indeed than they can be described by mere words.

As to the diagnostic value of the clinical course of the case, much importance may be attached to the discovery of a tumor presenting the characteristics already described and unattended by pain or disturbance of general health. The chronicity of the case is also of value. When suppuration has set in, the condition is, for all practical purposes, one of abscess, which will present all the phenomena of that affection, but differing from it in giving a history of preceding hepatic tumor.

Syphilis of the liver gives rise to an enlargement which may be irregular, but palpation shows such enlargement to be firm and not elastic and semi-fluctuating.

Cancer is attended by pain and cachexia, both of which phenomena are absent in hydatids.

From pleurisy with effusion hydatids of the liver are to be differentiated by the course of the line of percussion dulness. In the latter it curves upward, the summit of the curve being in the axillary region; in the case of pleuritic exudation the highest point is in the dorsal region.

When perforation into the pleura takes place and suppuration ensues, the physical signs are those of empyema, plus the history of hydatids as above described.

Prognosis.—The course of hydatids of the liver is a chronic one, the disease lasting for years. In some cases the parasite dies and progress of the growth ceases. In less fortunate cases the tumor increases in size and becomes a serious matter, ending fatally if not relieved by surgical intervention. Perforation into certain parts of the body constitutes a very serious accident; if into the heart or inferior vena cava it is rapidly fatal. Recent surgical experience has, however, given many excellent results, as the cysts are very readily extirpated. Aspiration, as a rule, is but a temporary expedient, the cyst rapidly refilling.

Treatment.—There is no medicinal treatment especially applicable to the treatment of hydatids of the liver, or indeed of any other organ. The only published homœopathic experience of late years is that of von Musitts, of New York, and his case was ultimately cured by operation. Every case, as soon as recognized and the progressive character of the case determined, should be submitted to radical operation.

ECHINOCOCCUS OF THE LUNGS AND PLEURA.

Hydatid cysts of the pleura may attain a large size. The symptoms are such as would be expected from a cystic growth developing in this locality. There are compression of the lungs and displacement of the heart. The physical signs are those of pleural effusion, the line of dulness, however, being quite irregular. Despite the severity of the local condition, general symptoms are mild or absent. The diagnosis can only be made with any certainty by aspiration of the cyst and examination of its contents for echinococcus hooklets.

Hydatids of the lungs are far more common than the same condition occurring in the pleura. They are especially liable to affect the right side. Any portion of the organ may be attacked, but the points of predilection are the central portions and the bases. Hydatid cysts of the lungs may exist for a long time without causing any disturbance. Sometimes they are accompanied by cough, dyspnœa, hæmoptysis, and pain. Fever is absent. The physical signs are those of tumors of the lungs. They are liable to excite destructive inflammation of contiguous structures, resulting in gangrene and cavities. Sometimes the cyst ruptures spontaneously, in the majority of cases into the bronchial tubes, occasionally into the pleura or pericardium. The occurrence of this accident is announced by the sudden advent of pain and the expectoration of a large amount of fluid possessed of the characteristics detailed in the article on echinococcus of the liver. The microscope may detect echinococcus hooklets in the sputum; a number of daughter cysts may be expectorated. Hæmoptysis may be profuse. Death often takes place by suffocation at the time of the accident. In other cases, the illness follows the ordinary course of pulmonary abscess. The sputum then becomes fœtid, and all the constitutional symptoms of suppurative disease appear. The treatment of pulmonary and pleural hydatids is the same as hydatids elsewhere, *i. e.*, strictly surgical.

ECHINOCOCCUS OF THE KIDNEYS.

Echinococcus of the kidneys closely simulates clinically hydronephrosis. The diagnosis can only be made by aspiration and examination of the contents of the cyst. Exceptionally the echinococcus hooklets may appear in the urine.

NEMATODES (Round-Worms).

Synonyms.—Round-worms; thread-worms.

The nematodes are inarticulate, slender and round, with well-marked tapering of one or both extremities, a well-developed interior cavity, with a mouth at one extremity and an anus at the other. They are surrounded by muscular walls and an elastic integument which is thrown into transverse folds. The female is usually much larger than the male.

The more important of the several varieties infesting man are (1) *Ascaris lumbricoides;* (2) *Oxyuris vermicularis;* (3) *Trichina spiralis;* (4) *Anchylostomum duodenale.*

ASCARIS LUMBRICOIDES.

Ascaris Lumbricoides, round, or long round-worm, lumbricus and maw-worm are synonymous terms.

Next to the oxyuris vermicularis this variety is the most common

and widely distributed of intestinal parasites and is the largest member of the group. It is round, with tapering extremities, and of a brownish or reddish color. The male is about eight inches in length and the female about double that. The male's caudal extremity is curved to the ventral aspect, forming a hook, the cloaca being located within the concavity with two adjacent chitinous hooks. The caudal extremity of the female is straight. The genital aperture is located at the junction of the upper and middle third upon the ventral surface. The eggs are exceedingly numerous and readily detected, being about 0.05 millimetres in length. The external color of the ova is dark. They are surrounded by a double shell with an external layer of albuminous matter. The surface is somewhat nodulated. Their power of resisting external influences is marked, as neither a considerable degree of heat, drying or freezing is sufficient to destroy them. They may possess power of development for several years. It is believed that the worm is developed from the ovum taken into the digestive canal in contaminated water, and in other ways not yet understood. Failure to develop the parasite as the result of feeding the ova, has led to the supposition that an intermediate development within some other animal is necessary.

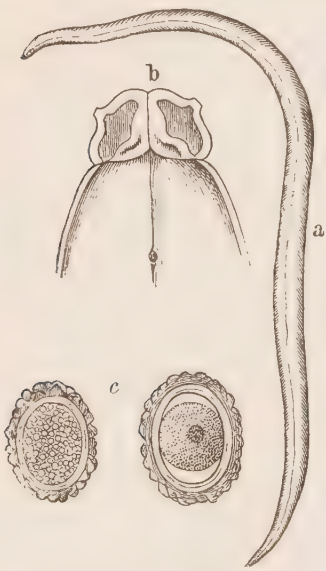


FIG. 69.—ASCARIS LUMBRICOIDES. (*a*) WORM; (*b*) HEAD; (*c*) EGG. (*a*) HALF NATURAL SIZE; (*b*) SLIGHTLY MAGNIFIED. (von Jaksch.)

Children and women are more frequently affected than men. The influence of general cleanliness, especially in the preparation of food and the securing of pure drinking water, upon the prevalence of this parasite, is very considerable. Davaine states that the roundworm is common in the rural provinces of France, but rare in Paris, where the inhabitants drink only filtered water. The greatest prevalence is among the half-civilized tribes of warm climates, consequently in Asia, Africa, India, West Indies, South and Central America.

The small intestine is the normal habitat of the ascaris. From this point it is inclined to migrate in some instances. Passing through the œsophagus they may enter the air passages, causing suffocation or inflammatory changes and gangrene. They may also pass into the nasal chambers, or rarely, into the lachrymal duct or eustachian tubes. Children sometimes vomit them. The bile-ducts may be entered with resulting jaundice or the development of cholangitis or abscess of the liver. Perforation of the intestinal wall may occur with their escape into the

peritoneal cavity, and the formation of abscess and fistulæ may result in the appearance of worms in the pleural cavities, pericardium, the urinary passages, or upon the cutaneous surface.

The number of worms present may vary from one or two to many thousands. When numerous they may excite much irritation of the mucous membrane, or become interlaced and obstruct the bowel. It is not uncommon for other nematodes or tape-worms to be associated with round-worms.

Symptoms.—In most cases there is an absence of symptoms, a knowledge of the existence of the worms being gained from their expulsion from the body either at stool or by vomiting efforts. The appetite may be impaired, excessive or morbid, and the breath offensive. Attacks of gastric or gastro-intestinal disturbance are common. Colicky pains may be a persistent symptom. Serious, and fortunately, unusual results are ulceration and perforation of the intestines, convulsions, chorea, etc.

In some instances the patient loses flesh and strength, picks the nose because of itching, or this symptom may involve the general cutaneous surface. There may be a slight night fever or fever of remitting type. The sleep is restless and there is grinding of the teeth.

The symptoms excited by migration of the parasite include vomiting and other evidences of gastric irritation if the stomach is invaded; jaundice, and perhaps later, symptoms of inflammation or of abscess of the liver, if the biliary ducts are entered; and suffocation or symptoms of pneumonia or pulmonary gangrene if the air passages are obstructed.

The number of worms which have been passed by a single individual in the course of several years has amounted to several hundred.

Diagnosis.—In most instances this is established positively by the expulsion of one or more worms. If irritation of the nose or skin, gastro-intestinal irritability, or other symptoms suggestive of worms are present, the stools should be examined for the eggs of the parasite which, by reason of their size and large number, are readily detected.

Prognosis.—With the exception of some of the very rare conditions excited by the round-worm the outlook is entirely favorable. Microscopic examination of the fæces will show the presence of eggs if the treatment has been ineffectual.

Treatment.—The careful prescription of homœopathic remedies is often sufficient to secure the disappearance of the round-worm without the aid of drugs directed solely to their expulsion. Of the latter class *santonin* is the most popular, of which one to two grains may be given to adults at a single dose. Children of two or three years should receive one-fourth of a grain, and those of five or six years one-half grain at each dose. These doses may be repeated several times daily. Yellow or blue vision, icteric hue of the skin and serious nervous symptoms have been reported from the use of santonin; but, although I have administered it

a great many times, I have never observed unpleasant symptoms of any kind. Santonin is often successful in very small doses. *Naphthalin* in three- to fifteen-grain doses, repeated three times daily, is very efficient. The powdered crystals may be washed down with a little water. It is advisable to feed the patient meagrely for a day or two previous to administering an expellant. Remedies of this character should be followed by a laxative within four to eight hours. *Calomel* is strongly recommended for this purpose, for the especial reason that it possesses considerable anthelmintic power.

Cina is an admirable remedy for children, and is called for by disordered digestion, vomiting, itching of the nose and mouth, colicky pains fever, restlessness, and even convulsions. If cina controls the symptoms the worms may disappear, but not always. If the eggs do not disappear from the stools, or some symptoms continue, *calcarea carb.*, *lycopodium*, *mercurius* or *sulphur* may be administered according to the indications.

For the acute symptoms excited by worms, we may also employ *aconite*, *gelsemium*, *belladonna*, *cicuta*, *ignatia*, *nux vomica*, and *podophyllum*, and for more persistent disorders, *argentum nitricum*, *cinchona*, *dolichos*, *ferrum*, *silicea*, and *stannum*. *Sabadilla* and *spigelia* have some reputation as essential remedies against round-worms.

OXYURIS VERMICULARIS.

The most common of intestinal parasites in man and one which is peculiar to him is the Oxyuris vermicularis commonly called the seat-, pin- or thread-worm. Its chief peculiarities are its small size, active mobility, and the irritation of the rectum which it causes. The length of this worm is about one-half inch in the case of the female, the male being about half as long. The tail tapers to a point in both, that of the male being curved ventrally, forming a hook with which the female is seized. The penis is in the form of a chitinous spiculum, which may be seen near the tail. The vulva is located near the middle of the body. The head in both sexes is blunt, and presents three papillæ arranged about the mouth. The numberless eggs are oval, and measure about 0.05 mm. in length, are granular, and enveloped in a transparent albuminous layer. They are usually found in the collection beneath the finger-nails of the subject, as well as in the bowel discharges. Infection and reinfection occur from introduction of the eggs into the mouth in various ways which may be readily conceived of. In

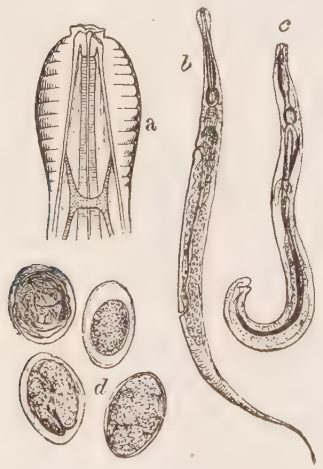


Fig. 70.—Oxyuris Vermicularis. (*a*) Head; (*b*) Male; (*c*) Female; (*d*) Eggs. (von Jaksch.)

the stomach, the outer envelope is destroyed, development continuing with the downward movement of the ovum. It is believed that the female becomes pregnant in the lower portion of the ileum, and migrates into the cæcum, leaving the developing embryo and the males in the jejunum. The impregnated female discharges her eggs in the rectum as she descends to be expelled. Seat-worms are actively mobile, but have little power of progression if resting upon a dry surface. They live but a short time after their discharge from the bowel. This parasite is found most frequently in children and women, especially those in the lower walks of life, who are uncleanly. The limited life of this worm would soon lead to its disappearance were it not for the constant reinfection which is going on, the eggs being readily transported from the anus to the mouth by the fingers.

Symptoms.—Itching of the anus is the symptom most constantly present, although a few cases are free from it. In these the worms have not yet occupied the rectum. The prominence of this symptom at night is due to descent of the worms into the rectum at this time, which is favored by the quiet state of the patient. Itching of the nose is also a common symptom leading to rubbing and boring.

Very marked nervous symptoms may be excited in neurotic subjects, viz., restless sleep, twitchings, startings, grinding of the teeth, and rarely, convulsions.

The digestion may be disturbed with impaired or morbid appetite, colic, and diarrhœa. The worms escape from the rectum readily and are found upon the bed or perineum, and about the genital organs, where they cause much itching and even catarrhal inflammation. In both sexes the irritation which they excite is a common cause of the establishment of the habit of masturbation.

Diagnosis.—Seat-worms are readily detected in the stools, on the skin, or in the bed of the infected individual. Failing in this, the ova should be looked for with the microscope.

Prognosis.—The prognosis is good, the worms being readily expelled, but great care is necessary to prevent reinfection which may continue the case for many years Even after apparent cure, mucus scraped from the rectum may show the presence of eggs, which is an indication for persevering with treatment.

Treatment.—The obstinacy under treatment is due, as suggested, to reinfection, which indicates the necessity for the greatest cleanliness on the part of the patient, or the nurse in case the patient is a child. The nails of both should be kept short and a stiff nail-brush used repeatedly each day.

If the worms do not disappear after the administration of *cina*, *santonin*, *mercurius*, *teucrium*, *sulphur* or other appropriate remedies, it is best to expel them by means of a laxative which may be composed of

mercurius dulcis in the first decimal trituration, three-grain powders being repeated every two hours until the bowels have been moved freely. It should be followed by some saline. Succeeding the catharsis large intestinal enemata should be used, consisting of warm water strongly impregnated with common soap. The intestine should be well distended, as the eggs are inclined to lodge in the folds of the gut. I have also observed excellent results from the *naphthalin* treatment as directed for roundworms.

TRICHINOSIS.

Synonym.—Trichiniasis.

Definition.—A disease produced by the entrance of the trichina spiralis into the organism.

History.—Although cases of trichinosis were observed seventy-five years ago, the true value of the observations was not appreciated until Zenker, in 1860, described the first authenticated case. Prior to that time, the lesions produced by the parasite were either misinterpreted or regarded as dissecting-room curiosities. Zenker's first case was regarded in the beginning as one of typhoid fever, the correctness of the diagnosis not being doubted until the end of the first week, when general muscular pains and pneumonia set in, and the patient died. The autopsy disclosed the presence of trichinæ throughout the body. The investigation was aken up by Virchow, who fed a rabbit with portions of the muscular tissue taken from the patient, with the result of producing trichinosis in the animal. The first diagnosis of the disease during life was made by Friedreich, in 1862. The first recognized case in the United States occurred in 1864.

Mode of Infection.—It is now generally conceded that trichinosis, as it occurs in man, is the result of eating imperfectly cooked meat from infected swine. The parasite is effectually destroyed by exposure to a temperature of 212° F. When, however, large pieces of meat are cooked, the innermost portions do not reach this point unless the cooking is prolonged, and thus some of the trichinæ escape destruction. The flesh of other animals than swine may become infested and in turn transmit the disease to man.

Of 2,057,272 swine slaughtered in Russia in 1877, 701 or 0.04 per cent. were found trichinous; of 2,701 swine examined by Billings, in Boston, in 1880, 5.7 per cent. were infected. Of 1,000 examined by Osler and Clement, but 4 were diseased; extensive observations from American sources are wanting because of the lack of systematic inspection of swine-flesh. Owing to rigid inspection of swine trichinosis has diminished greatly in frequency of late years.

Swine are believed to acquire the disease by eating the offal of infected animals. It has been suggested, however, that as the rat may

become the host of trichinæ, and as this animal frequents pig-sties and is frequently eaten by pigs, that the original source of the trouble is the rat.

Post-mortem examinations seem to prove that trichinosis in the human being is far more frequent than clinical observations would indicate. Thus it has been stated by those accustomed to working in dissecting-rooms and large hospitals, that from 1 to 2 per cent. of the muscles of all bodies are trichinous. Such statistics cannot apply to people in general, for they are drawn from a class notoriously careless in personal and general hygiene, and who are as likely to take their meat imperfectly cooked as not. Such observations certainly teach that the danger of trichinous infection is not small when careless preparation of food is permitted.



FIG. 71.—TRICHINA SPIRALIS. (*a*) MALE; (*b*) FEMALE, DISCHARGING YOUNG. (Heller.)

While statistics seem to show that infected meat is less common in Europe than in this country, trichinosis is more common in the former, and especially in North Germany, where the people eat freely of raw ham and sausage. Salting and smoking of the meat, no matter how thoroughly performed, is valueless as a prophylactic, as the trichinæ have been found alive in well-pickled meats.

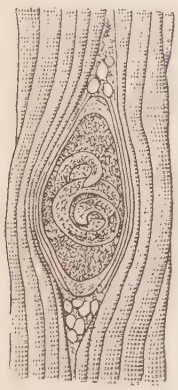


FIG. 72.—ENCYSTED TRICHINA SPIRALIS IN MUSCLE.

Description of the Trichina Spiralis.—The trichina spiralis is a nematode worm visible to the naked eye as a fine yellowish-white thread. It is slightly curved at one end, hence its name. The females are from 3 to 4 millimetres in length and the males 1.5 millimetres. The former are present in greater numbers than the latter. The parasites are always found in larger numbers at the beginning of the intestinal canal than elsewhere. Their cephalic extremity is thin, and their caudal thickened or rounded.

When trichinæ enter the stomach in diseased meat their capsules are first dissolved by the action of the gastric juice, and they are set free. Copulation next takes place, and in the course of seven days the female brings forth large numbers of young trichinæ. Several broods are brought forth, one female often producing thirteen hundred embryos. The mother herself dies in the course of seven or eight weeks, while the embryos

migrate. They first pierce the intestinal walls, and next the connective tissue, and finally lodge in the muscular substance. They appear there coiled up at first. They excite irritation and inflammation of surrounding structures and finally become encapsulated. The time occupied by the muscle trichinæ in reaching their full development amounts, as a rule, to about two weeks.

The trichinous capsules are generally of oval shape, and contain but one parasite each; exceptionally from two to four may be found. Ultimately the walls of the capsules undergo calcification. Sometimes the parasite itself takes on a similar change.



FIG. 73. — CALCIFIED TRICHINÆ. NATURAL SIZE. (Heller.)

The muscles especially liable to trichinous invasion are the intercostal, the diaphragm, and the muscles of the neck, eyeball and larynx. The muscles of the extremities are less involved as their distance from the trunk is greater.

Symptomatology.—The onset of trichinosis does not always present the same clinical picture. In some instances, symptoms appear within a few hours after partaking of the contaminated meat. These consist as a rule of the ordinary phenomena of gastro-intestinal irritation, as vomiting, epigastric pain, and diarrhœa. Such instances are unusual however, the first symptoms appearing at about the expiration of a week's time, and consisting of mental depression, alternating heat and chills, nausea, loss of appetite, coated tongue, and foul-smelling breath. Next appear the symptoms produced by the migration of the trichinæ into the muscles. These consist of severe pains, which are very liable to be confounded with those of rheumatism, and are greatly aggravated by motion and pressure. Unlike rheumatism, œdema is apt to be present, and is generally first noticed in the eyelids. The hands and feet are the least likely parts of the body to be affected by this symptom. The œdema is generally most marked over the affected muscles. They often become swollen. To relieve tension, the extremities are maintained in a position of semiflexion. Because of the involvement of the diaphragm and intercostal muscles, dyspnœa often becomes a source of great discomfort. The insufficient chest expansion thus occasioned may lead to catarrhal pneumonia. When the masseter muscles are involved, a condition simulating trismus appears.

Fever is a prominent symptom in nearly all cases, the temperature in severe ones reaching 104° F. Its course for awhile resembles that of typhoid fever very closely. In many instances it is quite irregular, and follows no definite type. The pulse and respiration changes coincide with those of the temperature. Sweating is profuse and a source of great annoyance if not of actual suffering.

Diagnosis.—The diagnosis of trichinosis is to be made by the knowledge that suspected meat has been partaken of, and that others who had also partaken are similarly affected. The symptoms on which most stress should be laid are the gastro-intestinal ones followed by the severe muscular pains, œdema, fever, sweating, and headache. The diagnosis cannot be made conclusive, however, until an examination of the muscular tissue discloses the presence of the parasite therein. Muscular rheumatism and typhoid fever are the diseases which are most liable to be mistaken for trichinosis. The former lacks the œdema and high fever, and the affected muscles are not as a rule the same as those which are the favorite sites of the trichinæ. Typhoid fever has a temperature following a definite type, the muscle pains are not severe, and œdema is absent.

Portions of muscular tissue may be removed for microscopic examination by means of a specially constructed harpoon, or by excision of a small piece under cocaine anæsthesia. The favorite situation for excision examination is the biceps or the pectoralis muscles.

Prognosis.—Trichinosis is always a very serious disease; in severe epidemics about one-third of the cases ending fatally. In mild types the disease may run a course of from ten days to two weeks. Sometimes seven or eight weeks elapse before the patient is well; and instances have been recorded in which the patient remained in poor health for years. The severity of the symptoms and the gravity of the case seem to depend almost entirely upon the number of the trichinæ in the muscles.

Treatment.—The most important point in the treatment of trichinosis is prophylaxis. This is to be secured by rigid inspection of all meats offered for sale, and thorough cooking of all prepared for the table. It must be remembered that the vitality of the encapsuled trichinæ is enormous, infection having taken place in instances in which the parasites were enclosed in calcified capsules. Even putrefaction of the meat does not destroy them.

When trichinous invasion is suspected, the bowels should be thoroughly and repeatedly emptied by the administration of a brisk purge. By this means many of the parasites are evacuated before they have had an opportunity of procreating. Fiedler's observation that glycerin destroys trichinæ may be taken advantage of, and that substance administered in doses of one tablespoonful every hour until about eight fluid ounces have been taken. When the trichinæ have invaded the muscles nothing can be done looking to their destruction. Remedies must then be prescribed on a purely symptomatic basis.

ANCHYLOSTOMUM DUODENALE.

Synonyms.—Strongylus duodenale; dochmius duodenalis; sclerostomum.

This is the only strongyle which is a parasite of man. An intermediate host is not necessary. It is a short cylindrical worm, the female measuring from five to nine lines in length, the male being a little more than half as long. The females are much more numerous than the males, and of a brownish or reddish color, which is due to absorbed blood. The male is lighter in color, even grayish. Their anterior extremities are pointed and recurve. The body of the male is irregularly pouched, particularly the posterior extremity, which condition is not present in any degree in the female. Her genital aperture is upon the ventral surface and in the posterior third. The mouth is large and provided with six teeth of a hook-like character, with which the worm takes hold of the intestinal wall. It occupies the jejunum and duodenum. The eggs, which are discharged in the intestines and found in the stools, are elliptical in shape, the largest varying from 0.044 to 0.063 mm. The transparent nature of the shell permits the brownish, segmenting centre to be readily observed. Continual segmentation is sufficiently characteristic to permit of a ready diagnosis of this variety. Water appears to be the normal home of this parasite external to the body. The ovum developed within the shell finally escapes, and, after a period of independent existence, may be taken in drinking water into the intestines of man where it undergoes complete development.



FIG. 74.—ANCHYLOSTOMUM DUODENALE. (*a*) MALE (NATURAL SIZE); (*b*) FEMALE (NATURAL SIZE); (*c*) MALE (MAGNIFIED); (*d*) FEMALE (MAGNIFIED); (*e*) HEAD; (*f*) EGGS.

Etiology.—The anchylostomum was first observed by Dubini, in Milan, in 1838. It was shown by Perroncibo to be the cause of serious disease characterized by a high grade of anæmia occurring in the laborers employed in constructing the St. Gotthard tunnel, and Griesinger demonstrated it to be the cause of the "Egyptian chlorosis." Of late it has been disseminated throughout Europe by Italian and Polish laborers and miners. It is found in India and in portions of South America, notably Brazil. I know of no positive evidence of its existence in this country at this time. It is largely confined to hot climates.

Symptoms.—The symptoms are due to the irritant influence of the worm which penetrates the wall of the intestine with its head and fills itself

with blood. When the worms are numerous, it results in serious loss of the vital fluid and also gives rise to ecchymoses, ulcerations, and seriously interferes with intestinal digestion and absorption. The degree of injurious influence is, of course, due to the number of parasites present, although serious deterioration of health has accompanied the presence of but a few. In these cases other factors were probably operative. The symptoms resemble those of pernicious anæmia. Those developing early are anorexia, nausea, vomiting, alternating state of the bowels, and some pain in the epigastrium or bowels. There may be obstinate diarrhœa. After the existence of these symptoms for a time, anæmia appears attended by its well-known symptoms. The blood loses one-half or more of its hæmoglobin, and the red blood-corpuscles are greatly reduced in number. The worms are seldom found in the stools, although their eggs are plenteous, also blood-corpuscles and the crystals of Charcot-Leyden. With full development of the symptoms, the patient is pallid and much emaciated. There may be various nervous disturbances, the urine may be albuminous, and hæmoptysis has been observed. The heart has been frequently found dilated and hypertrophied.

The course of the symptoms may be acute with a fatal termination within a few weeks or, with good care, the patient's life may be prolonged for months or even years.

Diagnosis.—The greater irregularity in the contour of the red blood-corpuscles, and the occurrence of retinal hæmorrhages in pernicious anæmia are helpful in distinguishing this affection from anchylostomiasis, but it is necessary to depend upon microscopical examination of the stools for a diagnosis, the segmented eggs being readily discovered if the parasite is present.

Prognosis.—A favorable termination results only from proper treatment. Spontaneous recovery has not been observed.

Treatment.—Infection may be prevented by filtering and boiling all of the water used for drinking purposes. If possible, only clear running water should be used. That from wells may be infected. General cleanliness should be encouraged in regions where this parasite is known to exist. The hands and face especially should be frequently and carefully washed; always before eating. The etherial extract of *male fern* in one- to two-drachm doses should be prescribed for the expulsion of the worms. The usual preparatory treatment, which has been already detailed, should be employed. There is difference of opinion as to the necessity of a cathartic subsequently to the administration of the medicine. Thymol is highly recommended, given in doses of a half drachm every hour until two drachms have been taken. A purgative is not required (Sonsino).

TRICOCEPHALUS DISPAR.

Of less important nematodes we may mention the TRICOCEPHALUS DISPAR, known as the *whip-worm* or *tricocephalus hominis.*

The female is about two inches in length and the male a little more than one inch. It is named "whip-worm" on account of its resemblance to a whip. The end to which the head is attached consists of a long spirally arranged thread—the lash—and represents about three-fifths of its length. The remaining portion—the handle—is thick, and in the male is rolled upon itself. The eggs are of a brownish color, elliptical shape, and about 0.50 mm. in length, having a granular yolk, and a transparent projection at either pole. These worms undergo full development within the body of man, being found in the cæcum and colon. The number present may reach thousands. It is a common parasite in Europe, being found in a large percentage of all bodies examined. Its presence is not usually attended by symptoms. Of late observations suggest that it may be the cause of an anæmia, which is usually associated with diarrhœa. It has even been thought to cause beri-beri. The diagnosis depends upon the discovery of the worm or of the dark-brown, lemon-shaped eggs, which may be present in the fæcal discharges in large numbers. No better treatment can be recommended than that already suggested for round-worms.

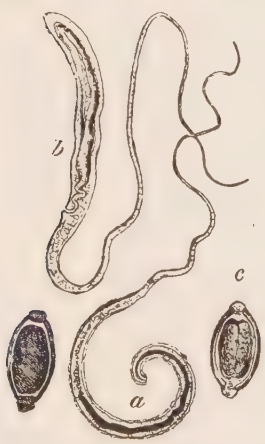


FIG. 75.— TRICOCEPHALUS DISPAR. (*a*) MALE; (*b*) FEMALE; (*c*) EGGS. SLIGHTLY MAGNIFIED. (von Jaksch.)

The **Amphistoma hominis** is a round-worm infesting the ascending colon and cæcum, and observed in the East. It varies from one-third to one inch in length.

The **Rhabdonema intestinale,** also known as the *rhabditis intestinalis* and *angulilula stercoralis,* is an unusual variety of round-worm which has been observed in portions of Europe, Brazil and Cochin China. It is less than a line in length and pointed anteriorly. It inhabits the jejunum, less frequently other portions of the small intestine. It occasions active intestinal catarrh or dysentery. It may enter the various ducts opening into the duodenum with resulting obstruction and disorder of the liver or pancreas. This parasite is taken into the intestinal tract in stagnant drinking water. The method of treatment recommended for the other forms of round-worm are also efficient for this variety.

Of the **fluke worms** we may consider those associated with the liver, bloodvessels and pulmonary organs.

Of blood-flukes the **Bilharzia hæmatobia** has been observed in

parts of the East and South, especially in Egypt and Africa. It is a cylindrical thread-like worm. The female is about two centimetres in length. It is found in the venous system of the abdominal organs, especially the portal veins. The embryos are supposed to gain entrance to the body in contaminated drinking water, but there is nothing definitely known regarding this. The eggs are oval in shape and have a spike at one extremity. They are readily discovered with the microscope. The symptoms are referable to the urinary organs, the most important being hæmaturia, which appears intermittingly. Most cases recover. They are seldom discovered after puberty.

Liver Flukes.—Passing several varieties which have thus far been observed only in ruminants, the DISTOMA CRASSUM may be considered, which is the largest form, measuring from three to six or eight centimetres in length. It is thick, smooth, and of elliptical shape. It inhabits the duodenum and has been observed in the extreme East.

Ijima and other Japanese physicians have described the DISTOMA ENDEMICUM and the DISTOMA PERNICIOSUM, which are endemic in certain provinces of that country. Some observers think it probable that both belong to the same species. Nearly one-fourth of the inhabitants of certain regions are believed to be possessors of this parasite.

Distoma Hepaticum.—This worm is in shape like a leaf, about 30 mm. in length and about half as wide. It possesses two suckers, one upon the head, the other upon the ventral surface. The genital aperture is between. The uterus is composed of convoluted tubes arranged in the form of a ball. The oval eggs are brownish, furnished with a shell in two layers, the broader end being furnished with a lid. Their length is about 0.13 mm., and they are 0.08 mm. wide. They may be found in stools. Several observers have discovered them in man.

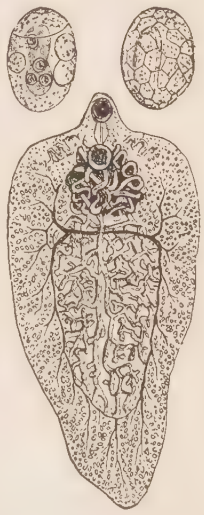


FIG. 76.—DISTOMA HEPATICUM. (von Jaksch.)

The liver flukes inhabit the bile-ducts, the duodenum and upper portion of the jejunum. They cause great enlargement of the liver, jaundice, ascites, diarrhœa, emaciation, etc. The alterations within the organs are various; cholangitis with extensive changes in the walls of the ducts is common. Changes in the parenchyma may result in abscess.

The bronchial fluke has been described by Ringer and Patrick Manson, and has been called the DISTOMA RINGERI. The term *parasitic hæmoptysis* has also been employed. This fluke has been studied in Japan, China, and Formosa. The symptoms are those of a persistent bronchitis. The expectoration contains the parasite. Hæmoptysis is a prominent symptom.

PROTOZOA.

A number of organisms of this class have been found within the intestines of man, but their relationship to diseased conditions of many has not been satisfactorily determined. We pass by the organism of Laveran, which has been described in connection with the subject of malaria (Vol. I, p. 139).

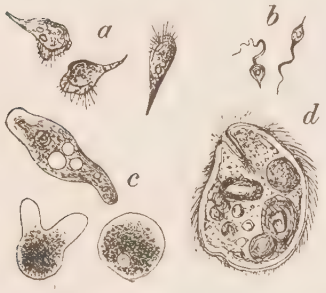


FIG. 77.—(*a*) TRICHOMONAS INTESTINALIS; (*b*) CERCOMONAS INTESTINALIS; (*c*) AMŒBA COLI; (*d*) PARAMŒCIUM COLI. (von Jaksch.)

The amœba coli will be considered. This is apparently the most important variety by reason of its relationship to dysentery. It was described for the first time with accuracy by Lösch in 1873. It is a round or irregularly elongated cell of 20μ to 35μ in breadth. It is granular in structure and enveloped in a transparent outer layer. There may be a nucleus and a nucleolus visible, also a number of vacuoles. It is capable of movement, putting out pseudopods in all directions. There may be one or two or quite a number visible at one time. When not in motion the organism is of a roundish shape. It is said to become encysted under certain conditions. The outer layer under these circumstances acquires considerable firmness and the organism is quiet, consequently preserves a round shape. Observations upon its destruction have been made in connection with dysentery. Quinine has proven most efficient in 1 : 5000 solution (see Vol. I, page 120).

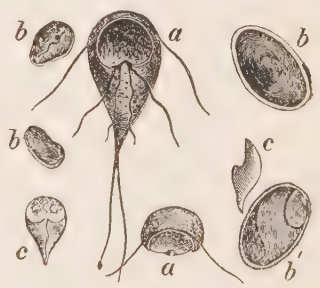


FIG. 78.—CERCOMONADS FROM THE STOOLS; (*a*) MEGASTOMA ENTERICUM (GRASSI); (*bb*) ENCYSTED FORM OF CERCOMONAS INTESTINALIS AFTER LOSS OF ITS TENTACLES (Lambe).

Megastoma Entericum.—This is an organism resembling a pear in shape and varying from 0.010 to 0.016 mm. in length, and having a peculiar concavity at one side of the broad end. A pair of flagella are found upon the anterior lip of this cavity, and two pairs closely related upon the posterior lip. The small end terminates in two fine thread-like extremities. Like so many other parasites, this one occupies the upper portion of the small intestine, where it attaches itself to the wall of the gut by means of its excavation. It has been found in large numbers in some cases of diarrhœa of infants, and Moritz discovered it in the evacuations of a healthy child. The colon and the stools may contain an encysted form, which is smaller than the active variety just described. The latter is seldom present in the stools.

Another pear-shaped parasite is the CERCOMONAS INTESTINALIS. The body terminates at the narrow end in a pointed filamentous extremity as long as itself. There is a flagellum at the broad end which is three times the length of the body. The length of this organism is from 0.008 to 0.012 mm. They attach themselves to the intestinal wall by means of the flagellum. They are capable of active motion. We do not yet possess evidence that they are peculiar to any form of disease, but they have been met in connection with a variety of affections characterized by prominent intestinal changes, viz., typhoid fever, dysentery, cholera, etc. Zunker found it in the secretion at the edge of the gums. Very weak solutions of corrosive sublimate 1 to 20,000 or 30,000 have been sufficient to destroy them.

Paramœcium Coli.—This is also a pear-shaped organism which is probably peculiar to cold countries, it having been thus far observed especially in Russia. It is larger than the preceding organism, reaching 0.06 to 0.10 mm. in length. It is granular, with a clear envelope possessing short cilia. A nucleus has been observed, and more frequently two contracting vacuoles. It has a mouth and an anus. It enters the body of man in the drinking water in which it has been deposited in an encysted form. The hog is its normal host.

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ERRATA, VOLUME I.

Page 62, line 19 from top, "nitrate" should be "nitrite," and 5 should be 0.5.

Page 461, line 18 from bottom, "thermometer" should be "dynamometer."

Page 539, lines 10 and 11 from bottom of page, "circular" and "radiating" should be transposed.

In making up the Index to the volume, the titles relating to "dysentery" were lost, hence they do not appear.

VOLUME II.

Page 932, "Tænia lavo-punctana" should be "Tænia flavo-punctata."